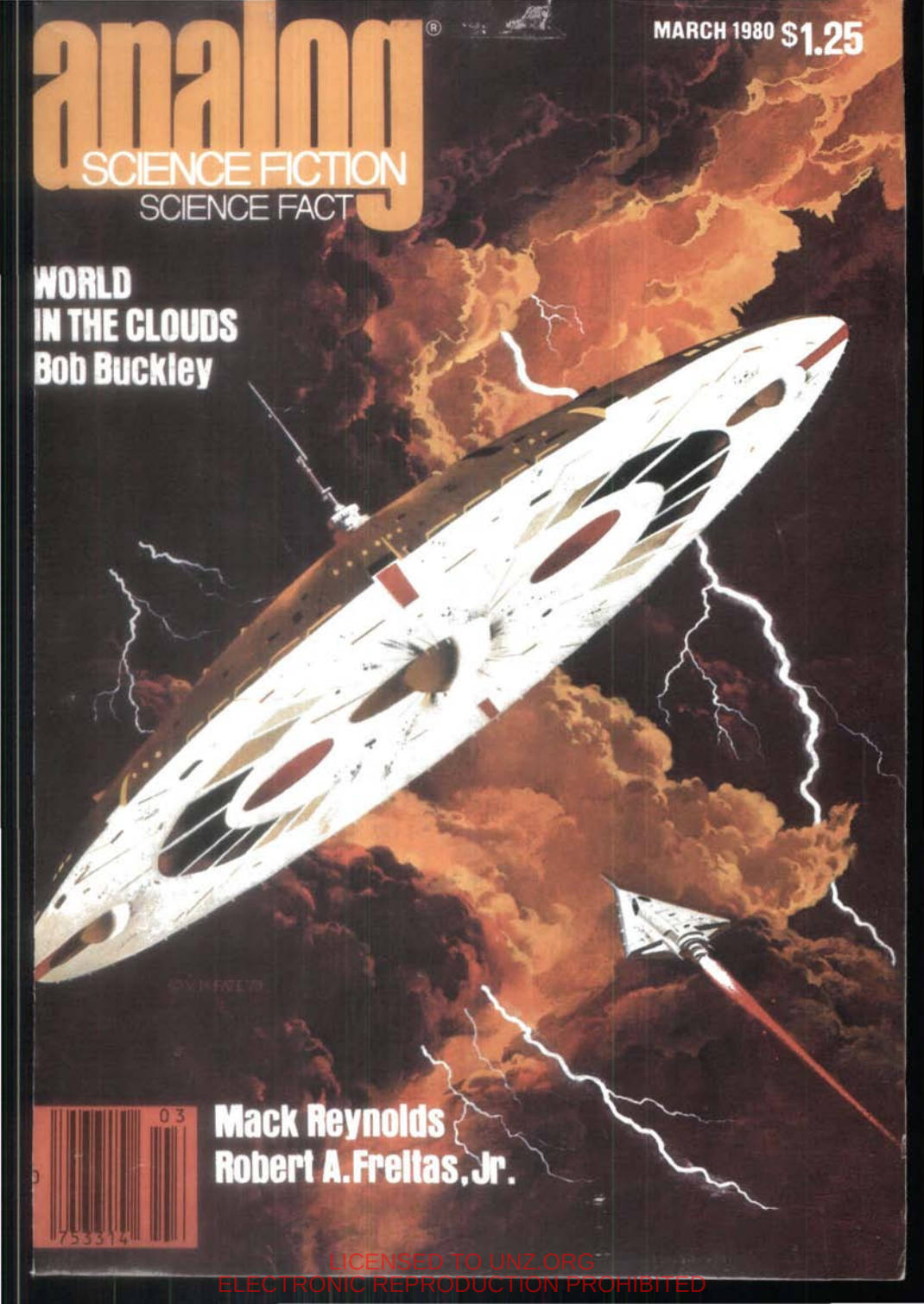

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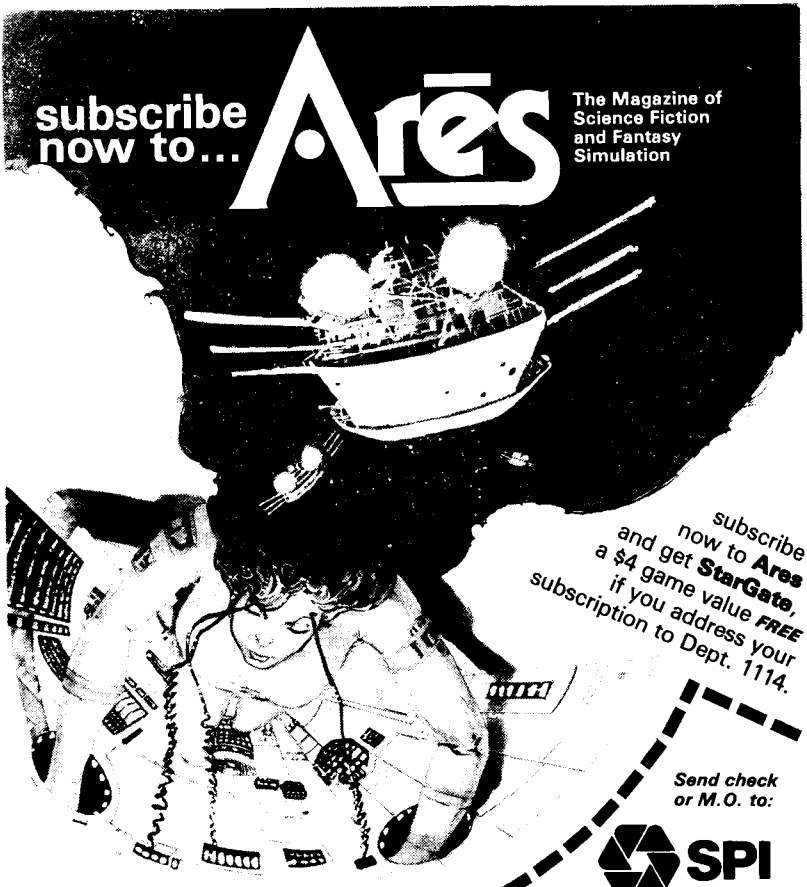

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Space For What?

Editorial by Stanley Schmidt

Science fiction folks have been speculating far longer than "normal people" on the establishment of human colonies beyond the Earth. Much of that speculation has focused on the colonization of other planets, either in this solar system or around other stars. Until rather recently, it seemed to be tacitly assumed by many that "conquest of space" was roughly synonymous with "colonization of planets." Recently, though, we have experienced a wave of awareness that that view was a mistake—that it was too narrow.

The recent emphasis has shifted largely to colonies *not* on planetary surfaces, but in self-contained and often entirely man-made structures in space itself—O'Neill colonies, various types of near-Earth-orbit space stations, hollowed-out asteroids, and such. So much so that I now see stories with these types of settings more often than those set on planets.

Is this a mistake, too?

The reasons for the shift in thinking are worth examining, I think—because I suspect they include (or reflect) a tendency to forget some important things about human differences.

Most of us can agree, I think, that a first reason for a shift of thinking away from planets and toward space stations is the barrage of discouraging information we've received about our neighbor planets. We are, at least technologically, ready to embark on a serious exploration and utilization of our own solar system—and *only* our own. We've made enough preliminary steps, via unmanned probes, to have rather definite answers to many questions which, until recently, were wide open to speculation. The answers are not encouraging. Not too many years ago it was possible to write about Martian canals and Venusian forests as things that might really be. Now it isn't. We know, to a rather high degree of certainty, that Mars is a desert with an atmosphere barely worth mentioning. Venus has a parched surface and the balmy climate of a

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pressure cooker, with a sky full of things you wouldn't want to spend much time in. The others, from our point of view, are still worse. The only planets we're ready to reach are, to put it mildly, not nice places to homestead.

So it's natural to look for other places to go. Reason number two for shift in emphasis: space stations provide such an alternative. A good deal of work has been done on figuring out how these planetless colonies could be built, occupied, and used, and it's pretty well established that *it can be done,* with technology not significantly beyond what we now have. An L5 colony can be founded more easily, according to some analyses, than a comparable colony on any other planet of our system—and quite possibly more easily than a colony on even the most Earth-like planet we might find orbiting some other star.

Finally, it is argued, quite correctly, that space stations near Earth can provide relatively immediate benefits, not only to Earth (in the form of solar power, manufactured goods, etc.), but to those who staff them (in the form of pleasant living space). Numerous stories and articles have appeared, not only in science fiction magazines but in the general popular literature, portraying life aboard space colonies with most of the advantages of The Good Life on Earth and without many of its disadvantages. The colonists will have a pleasant, healthful climate—without unpredictable weather and destructive storms; highly productive, automatically tended farms—without diseases and pests; clean air—without industrial pollution or free-roaming bacteria; "gravity"—but a little less, perhaps, thus easing strain on heart and other organs; and surroundings looking, on the whole, strikingly like a pleasantly planned and landscaped city on Earth.

It is at this point that I think an unbalanced emphasis on space-station colonies fails to take into account something very important about human nature: its diversity. When you ask for *what* colonies will be built beyond Earth, you cannot escape asking also for *whom.*

Life as postulated aboard an O'Neill colony seems to me to resemble in many ways life in a sort of idealized New York City: convenient and comfortable, but essentially artificial, compact, and densely populated. This is not necessarily a criticism. New York City has much to offer, and for some people it is an ideal full-time living environment. They live there by choice, and they thrive and are happy there as they would be nowhere else.

Others, however, can suffer the city gladly only in small doses. I am one of those. I cheerfully work in the city a few days a week, and occasionally enjoy going in at other times to visit museums, theaters, and such. I could adjust to living there all the time, if I truly had to. But I am far happier if I spend much of my time well outside. I have, it seems, a deeply ingrained psy-

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chological need to be closer to the land than I can get anywhere in a large city. City dwellers by choice sometimes find this need as hard to fathom as I find their lack of it, but this doesn't mean either of us is "wrong." It does mean we are *different*, and if we went into space, we would tend to seek different things.

Several years ago, Analog published a memorable short story called "Light of Other Days," by Bob Shaw, which has since been anthologized many well-deserved times. Central to the story, in case you haven't read it, is "slow glass," which traps light and lets it out, in the same spatial patterns and temporal sequence, after a long delay. A pane of slow glass could be stood in front of a pastoral scene for a year and then taken inside a house to act as a "scenedow," indistinguishable from a window looking out on the original scene as it lived through that year. "The commercial success of slow glass," the narrator tells us, "was founded on the fact that having a scenedow was the exact emotional equivalent of owning land.... A man who really owns tailored gardens and estates doesn't spend his time proving his ownership by crawling on his ground, feeling, smelling, tasting it. All he receives from the land are light patterns...."

Much as I admire that story, even after many rereadings, I can't quite agree with this statement. No doubt there are landowners who do nothing with their land but look at it, and to whom the fact of ownership is of paramount importance. But when I have lived in a house with land attached, I *have* spent a good deal of time walking around, not just looking at it, but listening to the things that lived there and taking in the smell and even the feel of it as I worked the soil with my own hands. So have many of my friends. I currently live in an apartment with perfectly gorgeous light patterns visible through the windows—but one reason I may eventually leave it is that the hills from which those light patterns come are still not as close at hand as I would like.

Moreover, this closeness to the land need not have anything to do with ownership. I did not own the land I spoke of above. I have had similar feelings in many places quite far from home, in wildernesses owned by no individual. It's not quite true that if you have to ask why people climb mountains, you'll never understand—but it probably is true that you'll never understand by being told. If you *do* it—if you spend a day or two pulling yourself up slopes with your own muscles and your own feet and hands on bare soil and rock, and perhaps wait out a thunderstorm at timberline and spend fifteen silent minutes alone in a glade with a deer at dusk, before sleeping under the stars to restore your strength to go back down—then you may begin to understand.

What I'm talking about, if you must pin a name on it, is a consciousness of being a part, an active member, of this world and all the

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variety it includes. Not a mere sense of "belonging," in the sense of fitting some comfortable local niche, but a sense of being part of something much larger—and able to function, in some way, in a wide range of aspects of that something. I have felt it in New York City and on Alaskan tundra and Indiana farms and Jamaican coral reefs and in Guatemalan jungles, and more in all of them than in any of them. Each of these places, and many others, has offered something different and worthwhile—and intangible. To me, one of the greatest blessings of technology (and one of the measures of success of a technology) is the chance for an individual to experience a little more of the universe he belongs to than the minuscule corner of it he was born in.

All Earth, of course, is a minuscule corner of the universe, but I can dimly imagine what other places there are, out there, and I would jump at the chance to go see some of them. That, in the very long run, will be a major attraction of space for some people. And these people, who want to see and hear and feel and smell all they can, are not likely to be long satisfied with artificial colonies, for this variety, and this intimacy with the natural universe, will be hard to come by there. No matter how large a space station, or how skillfully its makers simulate a piece of Earth, it can hardly

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have the scope and the special kind of "sense of wonder" of an entire planet full of different kinds of wild places and different kinds of human cultures. To some people this will not matter, and it is likely some of these people will make the best early colonists. To others it will matter a great deal—and these, I suspect, will have an advantage in a much later phase of man's expansion into space.

I suspect that these peculiar leanings I've confessed in myself are rather widespread. Witness the fact that recent articles advocating space colonization in the near future often stress the desirability of moving industry and energy production into space to let the Earth "heal" or "become a garden planet again." There must be many people who *want* a garden planet—and not necessarily of the "manicured" type. For that reason, I suggest that in the very long run, when men and women are capable of going to the stars, many of them will want planets, not cans, to live on. They'll want them enough to battle through the hardships of interstellar flight and finding and learning to live on new worlds. Out there may well be planets more hospitable than any of ours, but they will be scarce and even the most hospitable will demand much of those who would dare to move in. But some will be willing to tackle it, because they will prefer a kind of life they can build only on a planet—and those urges, I think, are likely to be especially strong among those adventurous enough to make such a move. (Some may even be determined enough to take on the harsh environments we have here.)

One more point worth mentioning in this connection involves not vague philosophical grounds for life-style preference, but rather concrete questions of politics and temperament. Colonies in space stations, or on planets so hostile that they require sealed domes or something comparable, will necessarily be rather tightly controlled, with highly centralized facilities and government. In a small, closed ecosystem, there are a lot of things that must be done and others that can't be tolerated. Those types of individuals with a strong hankering for individual freedom will tend to prefer the elbowroom they can have on a reasonably tractable and not-yet-crowded planet. They might well grow restless on a long-inhabited, carelessly exploited planet such as Earth has become—but perhaps we will have learned enough here to avoid making some of the same mistakes on new worlds.

In-space colonies will be a very important part of our future. In the foreseeably *near* future, they will be by far the most important facet of space programs. Many people will find ideal homes there, and will continue to do so for a very long time. But let us not forget planets. There will remain people for whom only those can be real homes. For them, the space colonies will be only stepping stones—indispensable stepping stones—from which they will lead us (or our descendants) to the stars. ■

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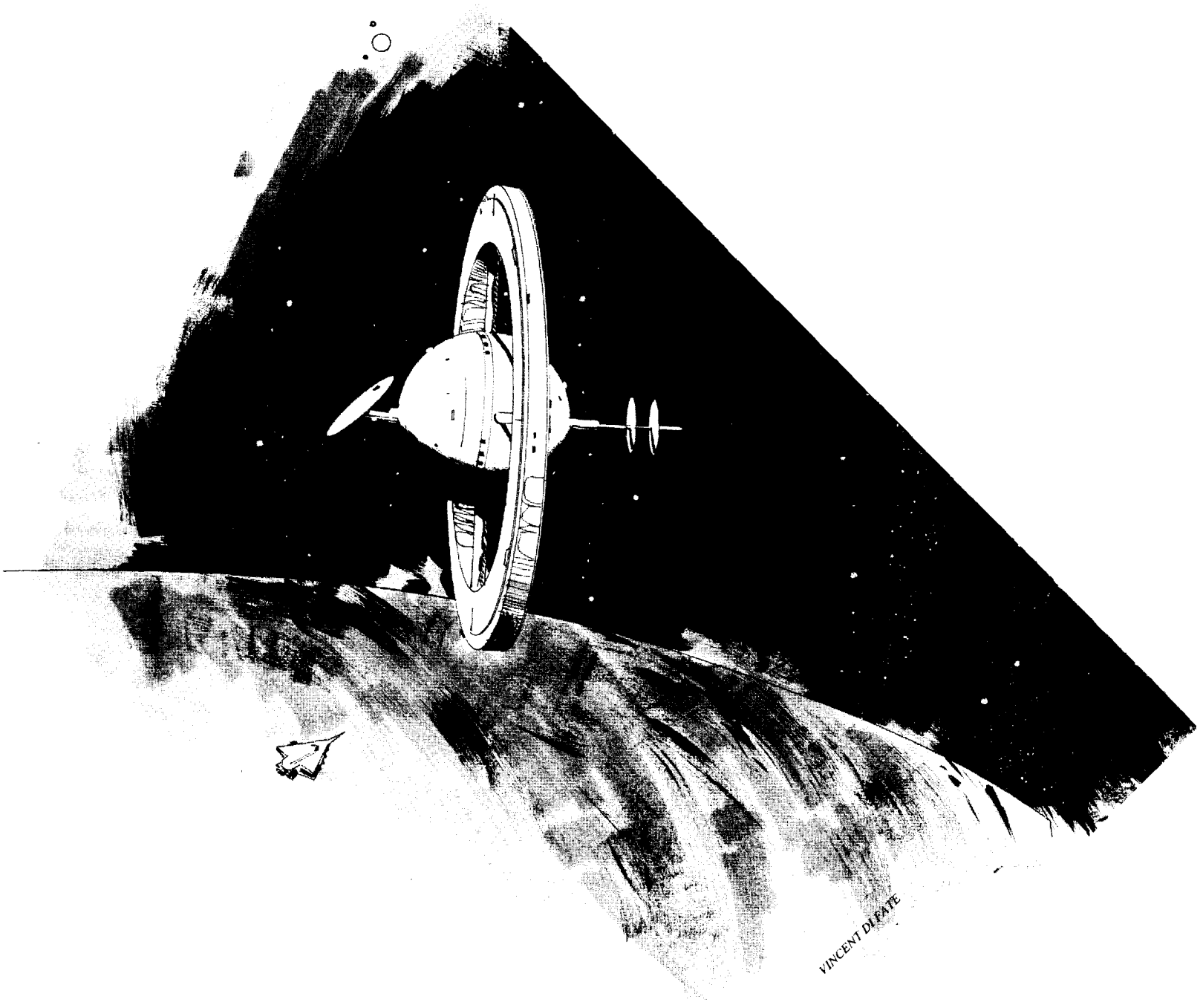

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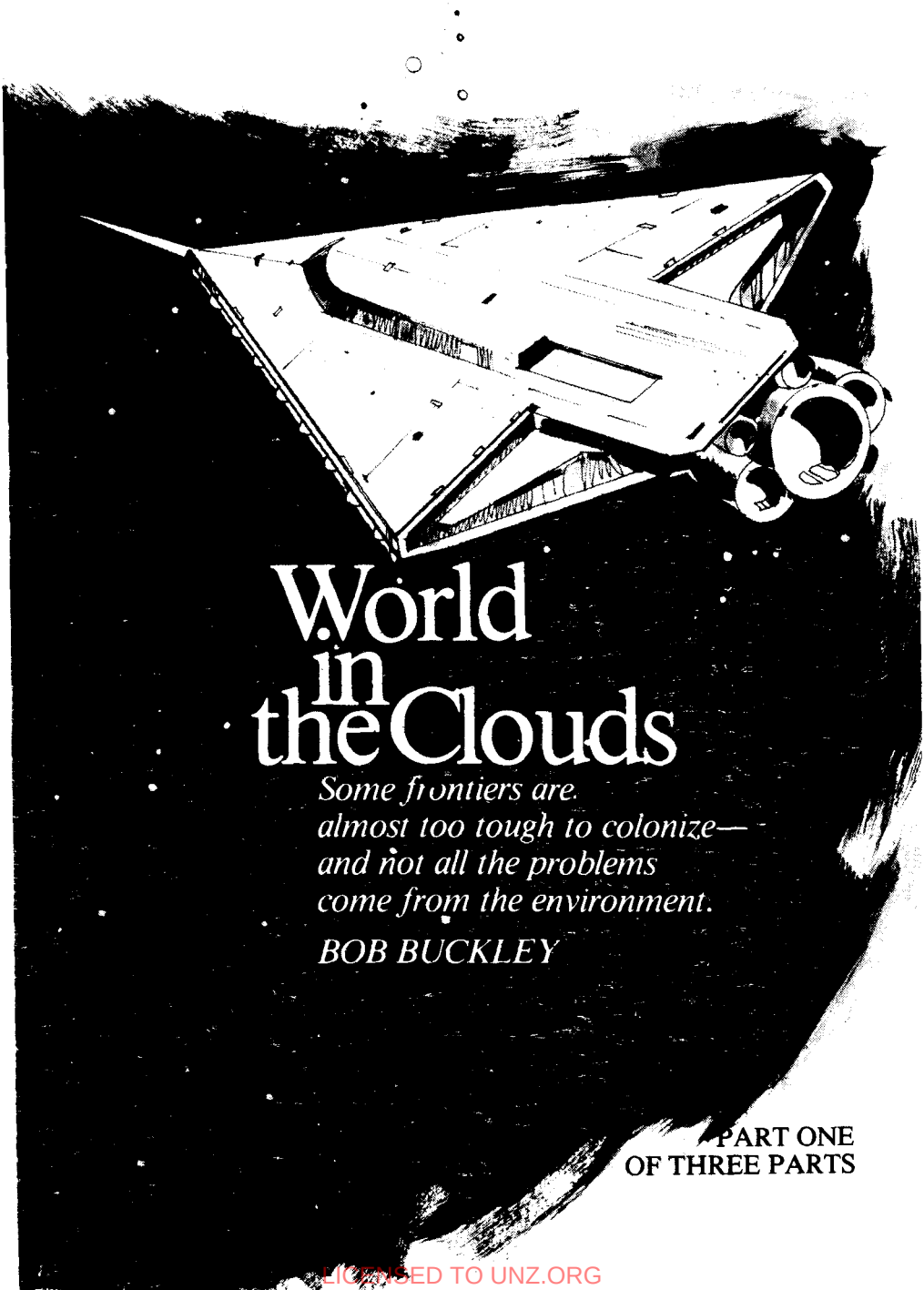

World in the Clouds

Some frontiers are almost too tough to colonize—and not all the problems come from the environment.

BOB BUCKLEY

PART ONE
OF THREE PARTS

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1

The AX-3 Groundmover idled on the flat landscape while its occupant stared at the bleak, gloomy scene and wondered just what he was doing there. For Captain George L. Callaghan the view was depressing, the dangers were frightful, and the benefits of this particular visit were nill. To add to his discomfort, the interior of the Groundmover was frigid. Punctuating the steady whine of the cooling system was the occasional plip-plop of condensation from the low ceiling. Ironically, the temperature outside the hull of the vehicle was 900 degrees F. He was very close to freezing to death in what amounted to a furnace.

Callaghan sent the Groundmover nearer a low mound of rock. The transponder was broadcasting from there, persistantly beeping over and over. White light from the Groundmover's lamp platform splashed across dull-colored boulders. One had been upended and the flat face read: MINING STATION CHARLIE — POPULATION 35. But the letters were just barely readable. The corrosive atmosphere had been at work and already the once sharp edges of the laser cut grooves were softening, melting as flake by tiny flake the stone was powdered and eaten away.

Venus had proved a cruel world blanketing herself with a misty aura of mystery. The mystery had lured some of the adventurous down to her bosom. But her surface was fatally hot, like the caked bottom of a boiled-out pressure cooker, and she was dead. Had been dead for millions of years, almost as though she liked things that way.

The beeping stopped abruptly.

Irritated, Callaghan spun the receiver dial. One more problem. One more to add to an ever-growing heap of disaster. So far, the mission had been a killer. As he told it to me later, he just wished he could have pulled up and gone back to the shuttle. At that time, I wasn't down on the surface. Fate, kind or otherwise, had removed me from the situation. Perhaps everything would have been simpler if I had just stayed. But is life really supposed to be simple?

Callaghan wasn't finding it as such. This was no joyride. Counting bodies isn't fun, and doing a recon on a failed settlement was certain to produce bodies.

Mining Station Charlie—Alpha and Bravo had both been abandoned as dry holes early on—had dropped off the air without any warning. One minute Meredith Craig had been calling off ore extraction figures, about to report on the lengthening of the Level Two Drift, when her voice ceased.

The signal had been cut off. Contact was never re-established.

Mining Station Charlie was the sole inhabited site on all of Venus, so there was no one to drive over and check how the settlement was faring. A search party—Captain Callaghan—had been sent down to the surface via an airbus. It had been decided not to risk any more than one man because

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...well, because the managing staff on the orbiting base were pessimists.

An airbus, despite its name, is merely a larger, more refined version of the powered gliders which had been used to establish Venus Base. There were two airbusses available. The first was in the process of being overhauled. The second, fresh from shipment out from Earth, was ready for a descent to the planet's surface.

Captain G. Callaghan and Lieutenant R. J. Lewis were selected for the mission. They were to carry a replacement transceiver for delivery to the mining station.

But that transceiver was still in the hold of the airbus. Callaghan, on his own authority, had decided that it would not be needed. Even from the air, during an initial pass, it was obvious that something was terribly wrong. Privately, Callaghan was already sure that there would be no survivors. But his orders were to make sure of that before leaving.

What could have been more cruel to have been left for dead in the hell that was the surface of Venus? Nothing! And that was why Callaghan was determined to carry out his orders, no matter how dangerous things got for him, or Lewis.

He gave up trying to pull a signal from the calling device, doubting that it was still operating. Venus was not a kind lady to man or machines.

The Groundmover's motor was idling softly, waiting.

In the distance, midway to the horizon, a red light was sputtering. It might have been anything from a young volcano, to a liquid metal spurt. Callaghan winced. He put the machine in gear.

Then he called up Lewis.

"I'm going in."

"Any signs of survivors?"

"No, not yet. But I'm still topside, on the plain. Maybe when I get inside there'll be somebody."

"Good luck, Captain."

"Thank you. I'll keep this circuit open. Listen up."

Callaghan sent the Groundmover lurching across the red-hot dusts.

Lewis settled down to waiting in the control room of the airbus. If bad came to worse, and Callaghan were disabled, or killed, he would have to activate the automatics and fly the bus up to the clean emptiness of space. He hoped that he wouldn't have to do that. He was fond of Callaghan. They had served together before on the engineering of the Tycho Deep-Space Receiver. Their wives even got on well. Not that they would be seeing their women anytime soon. But it would be rough breaking bad news to Becky. She was carrying Callaghan's second child. What a helluva time to lose a husband!

The young lieutenant tried to drive the gloom out of his mind with a magazine. But the words just drifted around on the page, and he found himself staring at the scanner screens again, fascinated by the terrible landscape beyond the ship.

Meanwhile, Callaghan, still very much alive, had driven up to the large,

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U-shaped portal of the mine's main airlock. He slowed the Groundmover and sent out a warning signal. This would activate an alarm within the airlock chamber. If someone were inside, they would know that he was about to cycle the lock on remote.

He waited three minutes exactly, and then started the procedure. A few minutes later the outer lock door broke into two jagged, interlocking segments and withdrew into a recess on each side of the frame.

Callaghan drove the Groundmover inside and sealed the outer door behind him. He paused only long enough to fill the chamber with breathable air, and then commanded the inner hatch to open.

That was like ordering a hurricane. A powerful wind shrieked in through the parting valves, scouring dust off the walls and floor, whirling it madly throughout the chamber.

Callaghan had expected something of the sort, so he wasn't surprised.

The mining station was breached, open to the massive pressures of the Venusian atmosphere. He would find no survivors simply because no one could live under such conditions. The fact that the airlock had functioned so efficiently had merely been a last tribute to terrestrial engineering abilities. The airlock was the strongest fixture of the entire station. It would remain intact long after the remainder of the station was crumbled into dust.

He began his report.

"Lewis, I'm inside. Mining Station Charlie has lost atmospheric integrity. There are no survivors. Please relay this topside. I'm going to drive in deeper to identify just what failed."

"Roger, Captain."

The big outside lamps played starkly across the smooth-cut tunnel walls, making shadows lurch suddenly as the Groundmover jolted over toppled beams, and the twisted junk of what had once been the amenities of Mining Station Charlie.

Callaghan shuddered as a lounge was crunched under the armored treads. The sound reminded him of bones breaking.

Where were the bodies?

Secretly, he hoped that he wouldn't find any. How long ago had this happened? A week? What would the corrosive atmosphere do to human flesh in that length of time?

He continued down the tunnel until he came to the end of the first level. An elevator rode a shaft down to the second level, but the Groundmover was too large to make use of it. Other tunnels fanned out from this centerpoint. The main ore body had lain beneath this area. The smelter, according to the diagram, was to the right. More living quarters were arranged along the tunnel to the left. That was where the administrative offices were.

Callaghan steered left, following the gentle arc of the main tunnel around the elevator shaft.

Then he came upon a pile of filing cabinets strewn across the tunnel like a dam. Some were broken open. The papers inside were black and crumbled. Pieces fluttered away from the

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approach of the Groundmover. They reminded Callaghan of falling leaves and of autumn on Earth. How long had it been since he had been back home? Five years? Six?

He drove over the dam. The weight of the Groundmover crushed the metal cabinets flat.

"Lewis, I'm at the Director's office. Everything is torn apart. When the walls failed the inrush of atmosphere must have been like a hammer-blow, smashing everything.

"Wait! Here's a safe. It's in one piece. I'm going to try to free it of its mount and put it in the carry-bin of the Groundmover with the grapplers."

"How did you get inside the office?" Lewis inquired.

"Broke down the wall. For once I'm glad this beast of a machine is so large. Hang on a moment."

Lieutenant Lewis waited through a long, anxious period of silence.

"Got it," Callaghan reported finally. "This baby is as delicate as a bull elephant. Brought most of the ceiling down on me, but I managed to back out of the rubble pile. I know why the roof failed. I'm taking pictures now. I'll be up on the surface with you again in twenty minutes."

"I'll have our bird ready to fly," Lewis told him, not even trying to keep the relief out of his voice. What he had seen of Venus so far had only reinforced his initial opinion of the place. It was pure, undiluted hell. It should be shoved into the sun to make room for a decent planet.

When they took off for Venus Station he would be overjoyed to leave it all behind.

Silently, Lewis urged Callaghan on when the Groundmover came into sight on the screens. He wanted to be out of this pit. He wanted to go home, for living in this place was worse than being dead!

It was a little after this that I came into the story. I had not as yet met Captain Callaghan. That meeting was still in the future.

So was Venus.

2

I was unaware of what had occurred on the surface. Classes were taking up all of my time; classes and field trips out to the construction docks to become familiar with new equipment being developed. I had been so busy that I had almost forgotten about Venus, and her miserable environment. Perhaps that was my subconscious working. I knew what miserable environments were...I had grown up in one of the lowest, meanest slums of N'York. The Big Apple had gone rotten, and I had been one of the worms. It still surprised me that I could think about those years so calmly, with such detachment. I certainly hadn't been detached as those days had been unfolding. It had been like a war, a bitter battlefield where there were no victories, only wasteful skirmishes. It had been another world, savage and wholly without redeeming qualities. The only virtue was survival.

That had been our only god, survival. We worshipped treachery and butchery, and watered the slimy altars

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of our ever-hungry god with blood.

Sometimes I wondered that I was the same person who had stalked through those dark, silent alleys in a perpetual crouch. Now I was on the verge of getting my degree in Astrogeology. I could read, speak in a civilized manner, and even . . . and this was the hardest part . . . even turn my back to someone. God, but that had taken a long time to learn. Old habits die hard.

And most of it had come about because of Beth. Gentle, caring Beth. She had been my taming. Not with words, not with blows, or really anything that I could recognize. Maybe it was just for wanting something that I had changed. Suddenly, there had been something to work for. A future!

Yes, that was it. She had given me a future. The ghetto had never provided that. And survival had only meant another day to struggle through.

Now things were easier. I was happy for the first time.

Perhaps that was what should have warned me. But I was young, inexperienced. I didn't know much about life, yet. I still believed that when you arrived, you were there for good.

Tough luck, chump. That's what you get for believing!

Dr. Forsyth summoned me to his cabin on B-deck midway through the Applied Chemistry lab. That was odd. Chem was my worst subject, only a week ago old Forsyth had chewed me out for not trying hard enough.

What would this be? Another chewing?

The cabin was cool. There was only one light on, the stalked spot that Forsyth used over his desk when he was working.

"The old man looks uncommonly pale," I thought as I moved to the wall seat that he indicated I take. The cushion was hard.

We stared at each other in silence for a moment. I realized suddenly that Forsyth was having difficulty putting his thoughts into words. A cold trickle of fear began to creep up the back of my spine.

"I won't insult your feelings by dragging this out, Roger. You're strong, you had to be to have lived as long as you have. But, at the same time, I know how you felt about Beth."

He stopped and swallowed, looking away for just a moment.

Coward, I thought. Tell it! I knew then what it was going to be. I've always had this damned gift of jumping ahead of a conversation, knowing what someone was going to say before they said it. Sometimes it was an advantage. This time, though, it was nothing but a curse.

Forsyth forced his wandering eyes back to mine and locked them there.

"There was an accident down at the mine . . . Beth is dead. Everyone who was there is dead. It was a painless, quick death. That's the only comfort I can offer. I'm sorry. They only relayed word to me a few minutes ago. I thought you should find out from me at once, instead of hearing a rumor in the halls . . ."

"Go to hell."

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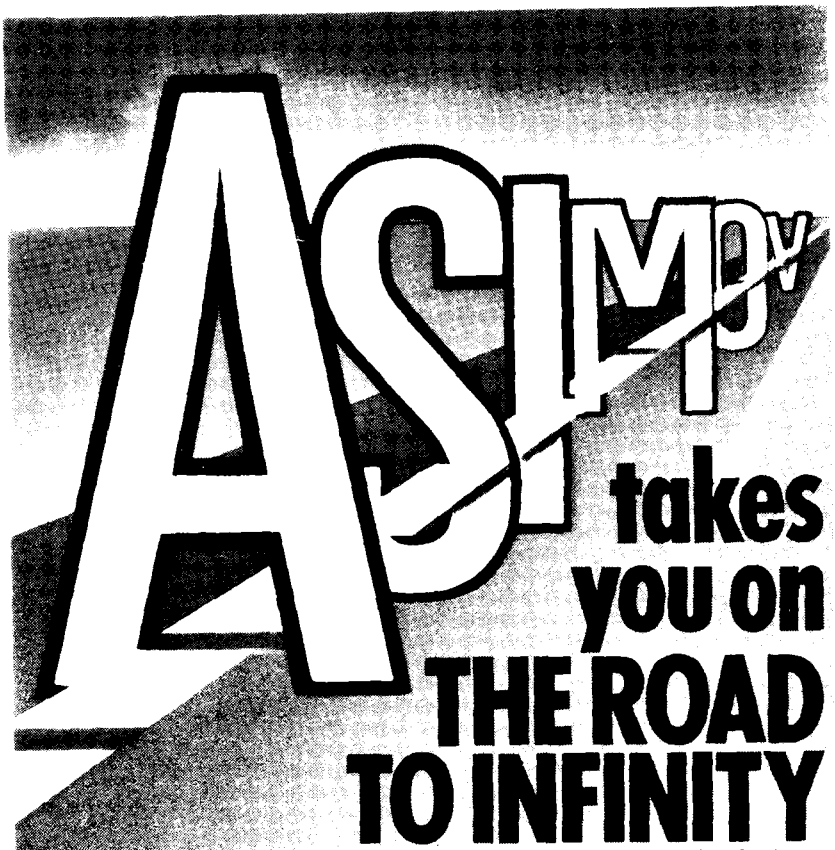

The Good Doctor Isaac holds forth on: hyperasteroids; the five rings of Uranus; mini black holes that disappear; the race for absolute zero; the death of the slide rule; the fifty million civilizations in our Galaxy that are more advanced than our own; and more; and more—all in true Asimovian style. "Candid, easy readability mixed with a wide range of sophisticated scientific knowledge and a roving intuition."—Publishers Weekly. Join the incomparable Asimov on THE ROAD TO INFINITY; $8.95 at all booksellers.

DOUBLEDAY

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The words flooded out of me in a burst. I sucked in a long breath. There should be pain. I knew that. But the only thing my mind was registering was the sour smell of the sheets on Forsyth's bunk. The odor seemed to swell until it filled the tiny working cabin. Behind Forsyth's bald head, through the porthole, I could see stars wheeling as the Station rotated on its axis.

"Why don't you take a few days off from class...go to the recreation area. I've already written a pass..."

"Goddamn you, knock it off. So she's dead. Big deal, she was just an easy lay that talked big." I laughed, wondering at the same time why I was saying all this. My mouth was flapping and I was just shoveling out words like garbage down a chute. No, like bullets. I felt trapped. Had to get out of the cabin, away from Forsyth. Away from everyone.

I stood up and put myself before Forsyth's desk, hands on my hips.

"Gimme the pass!"

He looked startled. I tore it out of his hand.

"I'll see you in a week. Thanks."

He caught me halfway to the door.

"Roger, not this way. Give yourself a chance to think. Don't throw everything away. I'll tell Dr. Anderson that you won't be in class tomorrow."

"You'll tell him nothing," I snapped. "Just tell him nothing."

The door boomed shut behind me. Then I was moving down the corridor, fast, shoving half-seen figures out of my way, ignoring their shouts. I headed for the lounge. There was a viewing chamber there, a big bubble of tempered plastic where one could sit and look out at the stars, hard, uncaring diamonds of light. They didn't twinkle, they just stared and stared.

I spent a long time there staring back, thinking, burying a dream, ignoring the water that washed down my cheeks. I felt dead inside. I wanted to yell, scream, but the emotions weren't there. I was a thing hammered out of metal, lacking feelings. I guess I was broken, but I would continue to work until some vital component crumbled away and everything inside me clattered to a halt.

Only in the past was there any shelter. I withdrew to the beginning and tried to savor the dusty memories. At first they came hard. Then the floodgates opened and I was there, back in the shuttle with Borland...and Beth.

3

The glider changed altitude. Electronic counters clucked softly to themselves as they monitored the change. There was little sensation to warn of the beginning of the descent except for a slight twinge in the inner ear, and the visual spector of the silvery limb of the planet dipping upwards past the bow ports in a giddy rush.

It was Saturday, May the 23rd. Venus was about to be conquered by representatives of mankind. Glorious words. The years of labor and expense required to construct and man Venus Station; to plan the attack, design and build the ships; it was all about to pay off. What great press it would make back home: Local Boys Make Good!

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Of course, the payoff would be for the Foundation staff since the people about me, the dice in this throw of fate who had been nominated as the ground crew of the mission were nothing better than a cageful of lab rats about to be dumped into the ultimate survival experiment.

Bitter, bitter. But those were my emotions. Young and dumb, I was keeping a log, a record of the trial that had turned my life over to the Federal Authorities of the Colony Relief Program—another piece of unwilling flesh for them to do with as they liked—and journal of the grim trip out from Earth. It hadn't been fun. Convicts weren't supposed to enjoy themselves. We didn't have rights.

The rushing fall grew more swift. By this time, both gliders were skimming the upper layers of the atmosphere, shuddering in the growing violence of the turbulence.

This was a one-way trip. Now, that wasn't really as bad as it sounded. On each shuttle the heavy thrust engines had been stripped to save weight. That left us with maneuvering power and very little else. We would be able to 'hop' about on the surface for short distances. But once we were down, it was for good. We would be 'natives' of Venus for the duration . . . until the airbus came down to pick up the survivors . . . if any.

Captain John R. Chaney, pilot of the lead glider, commander of the ground mission, alone in his glider partially because he was very near the weight limit for his craft, was in charge. His cargo was the big reactor that would power the ground station. It was heavy, very heavy. That was part of the reason that Chaney was alone. The other was that Chaney was a careful man. And he had learned that I was a convicted killer. Maybe he thought I was going to jump on him and do something terrible after we landed just so I could call myself the first human to set foot on the planet's surface. Well, that kind of fame I didn't need. Venus was hell. But he had 'bumped' me, and now he was out in front, blazing a trail. The blip that represented his glider drifted across the radar screen.

"I'M AT THREE THOUSAND... CONTINUING DESCENT."

Chaney's voice was tinny and metallic over the comm set.

"We read you, Airtruck One. Keep it up."

That was Borland. Hal Borland, our pilot. He hadn't objected to my presence. Perhaps he was more trusting. Or maybe it was just that Beth was along, and he figured that I would have more scruples than to strangle him with a girl that I obviously liked as a witness.

Borland was studying the radar altimeter with a thoughtful expression. Green light from the set played across his features. He resembled one of those rugged, adventure-prone captains of the Earth-Luna run. Besides being handsome, he had a solid, deliberate character, like a father, the kind the holo shows spoon up for mass consumption.

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Maybe it was for that reason that I hated him. My own father had been some unknown bum who had run off when I had been three. So I tolerated Borland, to his face I was civil and attentive. That was only smart. One false step and the Sayre Foundation would have every legal right to stick me in a sleep drum and render my lovable little carcass down into spare parts for the terminally accident prone.

I was on the ultimate parole, yanked from a dead-end ghetto in a dying city and given a new chance at life.

The price?

Behave. Learn how to be human again. And mostly, learn how to make myself valuable to my fellow companions. There was no spare baggage in the colonies.

"Three quarters there," Borland muttered, softly, probably just talking to himself. But Beth nodded, and her brown hair rippled as it overflowed the collar of her worksuit.

She was great. She looked pretty and she moved pretty, just like Lucy, the girl who had done the most to get me where I was today.

A man should not love a girl who almost got him killed. That's not logical. But love is not a logical behavior. Especially when you're seventeen. Love can hit you then like a tidal wave sweeping up a flood channel. It carries you along with the rest of the debris and whatever else got caught up in the wrong place at the wrong time.

It carried me the distance. And now I was making my descent into hell.

Beside the radar a microfile was playing out a continuous map strip of Venusian surface. The landmarks were familiar, by now. We had been through a simulation of this trip a hundred times, at least.

We were nearing the Termination Point.

That's a final way of referring to a landing site. Just seeing it on paper gave me the creeps. Termination was death . . . what they did to failures and oldsters who were beyond saving. But the geologist who had selected the term knew that he would not be one of those picked to make the initial manned descent. And the opinion of a convict on parole was not something of importance to the guiding officials of the Sayre Foundation.

I also thought that it was insane to attempt to establish a mining settlement on the surface of Venus. There were easier ways to collect minerals. But I was keeping that view to myself. My parole was clear on the subject of my work and my loyalty. I would do as I was told, and do it to perfection or face summary execution. My past had condemned me along with Lucy and the three souls I had left bleeding their life out into the gutters of a filthy and night-darkened ghetto street. That the same three souls moments before had been strenuously striving to let out my own life was immaterial to the law. I was colony fodder, and after a swift and streamlined trial had found myself on my way to the first artificial moonlet of Venus along with thirty other prideful young gutter animals of

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both sexes. The guards had kept us away from each other's throats well enough so that most of us actually made it to the duty station to begin our parole as a labor force for the scientists and administrators who had brought this grand design into being.

I put all that propaganda down in my book. It made the guard who read it on the sly laugh.

Another familiar landmark began to crawl across the mapstrip.

"Hell's Pass below," I called up to Borland.

Venus has some charming names. Places like Perdition Valley, Satan's Fangs, and the Plains of Hades. All the references to the nether regions get monotonous after a while. But what else can you name a place after when the invisible sun hangs overhead like a furnace for months and the rocky landscape broils under a windless calm of 900 degrees?

This ain't no resort.

The guard told us that just before they dumped us off the 'slave ship.'

And it ain't!

Borland's voice came to me, perfectly modulated, completely at ease. Oh, what a hero he was. I hated him some more while he talked.

"I see it, Roger. And Chaney?"

"On station. His descent seems normal. I think he should be setting down in about five minutes."

As if to confirm my statement, Chaney's harsh voice burst out of the bulkhead speaker.

"BEGINNING TERMINATION MANEUVER. FIRST BASE FORMATION IN SIGHT."

Chaney wasn't really seeing his landing point. Visibility on Venus is worse than terrible. The planet's long day was nothing more than a gloomy twilight. And the nights were like having your eyes bathed in the blackest ink.

Since there wasn't going to be anything to look at, the gliders were constructed like diving bells. And a diving bell wasn't such a bad comparison when you considered that the air pressure was as unhealthy for humans as the water pressure of the Marianas Trench back on Earth. The only 'seeing' was performed through television cameras linked to the outside world by fiber optic lenses. That was expensive. But I had already learned that everything about the Venusian Settlement Program was expensive.

It seemed like a hellish waste of time and money.

And maybe lives.

My life.

I shoved that thought away and tried to concentrate on the radar, ignoring the sudden dampness that was soiling my palms.

The blip told the story. Chaney's glider was practically on the surface. The landing would be a long slide across the soft, slightly rippled plain until the momentum of his gliding descent had been consumed.

This was a first. I could not prevent feeling some excitement. No living man had been this deep before, only his machines.

Even so, I knew what to expect. I had seen the photos sent up by the

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automated probes. The Venusian landscape was remarkably flat, with occasional resistant outcroppings of fresh volcanic material. Here and there could be found the gentle slopes of ancient crater walls. But there were no canyons, no towering, jagged-faced mountain ranges, and certainly no dark and heaving seas. Just barren, dark, flatness simmering in the incessant calm. The massive atmospheric burden that wrapped the planet in its smothering embrace insured calm in the cloudfree depths.

It also insured lifelessness. Venus was dead, stillborn, and so she would remain forever.

Despite the Sayre Foundation and all its grandiose plans for colonization.

"TEN MINUTES FROM FLIGHT TERMINATION." Chaney's voice thundered through the little cabin.

Startled, I could not help jumping in my seat.

"Watch him very closely, Teale," Borland ordered.

"God, let him make it," Beth breathed aloud.

The hands of the chronometer spun slowly as they counted off the passage of the precious, anxious seconds.

On my screen the blip had merged into the faint image of the Venusian surface.

"He's down. I've lost him."

Our own flight termination point was only minutes away, now. I tried not to think about it. There were so many things that could go wrong. This had never been done before. The stink in the cabin must have become aware of my uneasiness and it began to assail my nostrils with double strength. My stomach churned and my bowels felt watery and sick.

God, not here! I pleaded. If I gotta die, let me do it like a man, clean and noble. Don't let them find me cooked and torn among the metal spears of the wreckage smeared with my own waste. I want my respect. I fought too long to maintain it to lose it this way.

Fly this crate, Borland! Fly like you've never flown before. Save us, man. Be that hero that you look like.

My thoughts were racing like an uncontrolled engine.

Calm, stay calm. Have to stay calm. We'll make it. You're not going to die. If anyone dies it will be Chaney. You're in this glider, and you're immortal. Can't you feel it? You die? Never! No way.

I wrapped my hands about the seat arms and locked them. The plastic was hard and hot.

"I wonder why Chaney hasn't reported back," Borland said distantly, his attention was completely on the controls of the glider.

The seat rose and fell. We were being buffeted by a crosswind.

"Hell!"

"What's that Roger?"

"Five minutes away from Termination, Captain."

My voice sounded strange as I covered for my slip.

The weather probes had reported that at times giant storms spun down from the cloud ceiling and tore paths of raging destruction across the

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desolate flats. We were going to dig the mining camp into the side of a low mountain for that reason.

Was that little gust of wind the signal for the approach of one of those killer storms?

I stared at the radar screen in horror, expanding the sweep pattern frantically, searching.

But the screen was clear. The air was calm, and we were all alone. There wasn't even a mountain to run into. A child could land us if he just knew how to fly.

What would it feel like to take the controls? To feel the glider moving to my commands?

Minutes dragged past on leaden knees. Time knew no mercy and never would. Why did Beth look so calm, so efficient? Abruptly, I hated her too.

Chaney was holding his silence.

The surface reached up for us relentlessly. It was time to land.

It was time for Termination.

"Chaney had the reactor on board. If he's crashed . . ." The words told me that Borland's perfect calm had broken. Was he afraid, too?

Then I realized what he was talking about. Our glider carried the airlock assembly and the Bore by which we would excavate the mine. We carried consumables, but no power supply except for fuel cells.

Chaney's ship had been filled to capacity by the bulk of the reactor. His was to be the most dangerous landing for the glider would come down with a lot of inertia.

Both ships were on a one-way descent. We had no way up until the Station-to-Surface shuttle made its descent. But it wouldn't come down until we had prepared the mine chamber and made it livable. If we failed, we would be written off and an alternate mine site would be selected for the next glider descent. We had been told flatly that the Station Commander would not risk the sole operational shuttle in a wild rescue attempt should the first team find itself marooned on the planet's surface.

The red-haired, beefy-faced guard's words rang in my head again.

"This ain't no resort, punks."

The sweat on my palms was back again, making the plastic under my skin feel slimy.

I grimaced. A convict had no rights. I had merely traded one death for another. That thought was bitter in my mind. There was panic hiding behind it, leering. That was the way the odds were. If only Beth . . .

"Airtruck One, this is Borland. Please report status."

Borland repeated the call twice. But there was no answer, only the boom and crash of distant electrical disturbances in the atmosphere.

Then it was time to set down.

"Ten feet . . . level flight . . . surface coming up . . . wing skids down . . ."

Beth's voice was easy, relaxed, as if she landed on Venus every other day.

"Three feet . . . two . . . one . . . nose skid down, riding free. Horizon is clear."

Now we were careening like a high-speed toboggan across the searing flats. In my mind's eye I pictured us,

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the ablative covered hull black in the dim light. Behind our two stubby airfoils a roostertail of dust had sprouted. It streamed up and up until it was silhouetted against the scudding, convoluted underside of the racing cloud cover high overhead. We were an ebony angel fallen from heaven.

At one point in our slide the glider leaped wildly, lofted by a sudden rise in the sandy course. But Borland managed to win control after a brief struggle and then we were racing along in the shadows again.

Gradually the glider slowed.

With a shuddering lurch, we came to a halt, nose down slightly.

We had arrived!

It was still Saturday.

Abruptly I remembered that I had been holding my breath. I let everything out in a noisy sigh.

Beth started laughing and couldn't stop. She hid her face in her hands and made sobbing noises. So, she hadn't been as calm as I had believed.

As for Borland, he leaned back in his couch and gave a loud yell that bounced dully off the foamed interior of the cabin.

I stared, unable to speak. We were down, but everything still depended on Chaney. We could still be dead.

Without waiting for the order, I began scanning our present surroundings through the camera units. It took me only a moment to locate the other glider. It waited dark and silent a hundred yards away. It had lost its nose skid and was bow down in a mound of dust. The path of its run was plain to see as a deep and narrow ditch that stretched back along the flats like a raw-cut exclamation.

Although canted badly, the glider was still right-side up.

Perhaps Chaney had only lost his radio. Some thing might have torn his antenna away. There were a hundred reasons why he might be alive but out of communication.

When I informed the others of my discovery, Beth became sad-eyed.

"He's dead."

"We don't know that," Borland snapped at her. For the first time he actually looked uncertain.

He was turned around in his couch so that he almost faced me, his eyes on the bulkhead, scanning the equipment there. There was a new smell in the air, now. Scorched insulation!

A fire?

I unstrapped my restraints and moved aft, sniffing.

"It's up here, Roger."

Borland reached out and touched the instrument modules. A whir, unnoticed until now, began to fade.

"There's a backup. We can get along without it."

"What now?" Beth moved in her seat. Now we were down the job was beginning. The first round was over.

"Roger, level the glider. We'll take the crawler over to Chaney and see what there is to see."

Borland turned to the bow and began powering down to conserve energy.

"Beth, kill the lights. We'll have to make do on emergency power until we find out what the situation is."

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I continued aft, supporting myself against the low ceiling. Although the gravity was Earth-normal, I had been living for almost a year in the weaker artificial gravity field of Venus Station. I felt heavy and awkward despite exercise periods.

At the rear of the cabin was the exit lock to the cargo chamber. Beside it was the console that controlled the raising and lowering of the wing and nose struts. I started the electric motors and released the strut brakes. Shivering, the glider began to settle. The red light on the console panel glowed scarlet, blinked, and turned green. The hull now rested solidly on the surface of Venus.

Was the pressure seal to the cargo area intact? Yes, the check was merely a formality. If the hold had caved in under the pressure the entire glider would have crumpled like a can being crushed in a fist. Good air at normal pressure waited beyond the massive valve before me. I spun the wheel-lock and released the clips. The door swung inwards and the lights in the hold came up automatically.

Borland clapped my shoulder.

"Let's go. Beth will stay with the ship."

The crawler, low, squat, ugly as a toad, but strong as a bull elephant, waited before the cargo hatch. It was securely tied. If the machine had broken loose on the trip down its movements might have pitched it straight through the side of the ship.

It occurred to me that Venus had innumerable ways of flattening a man.

Borland started freeing the crawler from its web of cables.

I went around to the rear and began working there. Teamwork was required but there was little talk. I was uncomfortable in the presence of Borland. We had never talked much at all on the station. He was older, and my interests were certainly not his. Truthfully, I wasn't sure what he did for relaxation. Did he drink, or ingest happyweed? Was he a ladychaser?

"Catch!"

A cable end came flying toward me over the humped back of the crawler.

I snagged it in midair and looped it over a holdfast on the bulkhead.

The hatch on the starboard side of the crawler rose with a shrill whine.

Borland disappeared inside.

We wouldn't be getting into pressure suits. There were none. Nothing could protect us from the weight of atmosphere. If we were to move about on the surface we had to do it inside the shielding womb of our machines. As long as possible we would exist in a shirtsleeve environment. If there were a breach, a rupture in the hull, it wouldn't matter if we were in a spacesuit, or not.

The expedition was nothing less than a terrible gamble, and all of us knew it.

When the cargo hold had been pumped out and the noxious gasses had been allowed to flood gently and harmlessly inside at a controlled rate until the pressure inside and outside the hold had equalized, we opened the outer hatch of the bay and Borland

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ran the crawler out onto the surface.

Beth closed the hatch behind us.

There were no ports in the crawler for the same reason that the glider was 'blind' and solid. But TV cameras gave us a 360-degree field of view on the screens. The cameras were far more sensitive than our eyes anyway.

We did not pause to wonder at the scenery. What was to be seen was hardly worth commenting on. Venus was a slagheap of acid-washed cinders laid out smooth and crushed flat.

Borland called Chaney again. But neither of us expected an answer by this time.

We moved off across the darkened plain at a moderate rate of speed, raising just a little dust behind. Our exterior lights brought a flood of illumination to the landscape. How long had it been since bright, white lights had been known in this wasteland? Surely, in the planet's ancient beginnings, the sun had played on its surface. Where had the massive cloud banks come from? When had they begun to form, and for what reason? Why had Venus crushed herself to death under such a burden of atmosphere when, under different circumstances, she might have been a twin to the Earth, a second green star shining in the heavens.

Questions aplenty, but no answers.

Gradually, we pulled alongside Chaney's glider. Borland took us around the bow and stopped on the glider's opposite side.

There was damage that we had not seen before, a rent in the port side. There was a forced, puckered look to the wound, as if there had been a sudden inrush of air through it. If so, we would not have to worry about tending an injured man. What was left of Chaney would not need tending.

When the crawler was close to the hull, Borland ran a remote camera out on a flexible boom and attempted to thrust it into the rent. It went through easily, supporting our worst fears.

The two of us gathered about the screen. The control room was a shambles. The corrosive atmosphere had already turned all exposed metal surfaces black. The equipment looked burned. There was no sign of Chaney. But both couches had been torn from their mounts and smashed against the far bulkhead. One had stuck there, glued by the force of the blow. Nothing seemed to be where it should be. But the framing of the glider, miraculously, had not been crushed by the pressure. Perhaps we had built stronger than we suspected.

"Finished." I felt cold inside. I hadn't liked Chaney. Had known him even less than I liked him. He had been intent on his own affairs and had had very little use for convicts.

My guts churned a little.

"It can happen to us, kid. Don't forget that."

Of all the damnable things to say. I had to repress a terrible urge to seize Borland by the neck and give him a good squeeze. He didn't notice. He continued to peer at the screen calmly, not knowing how close to death his casual comment had brought him.

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"I wonder what did it?" he wondered aloud.

"Maybe a rock thrown up by the landing? A fault in the hulk?"

"Could be." Borland shook his head. "We'll probably never know. Chaney never knew what happened, that's for sure. The glider must have come to a stop on its own. Maybe we can still save the reactor."

He drove the crawler farther down the flank of the glider.

The technicians up at the Station had anticipated that it might be necessary for the crew of one glider to get inside the other without assistance. The cargo hatch could be operated remotely by a radio signal.

Just as Borland was about to transmit, I touched his arm.

"What if Chaney is alive and waiting in the hold?"

Borland froze. I could almost see the frantic thoughts whirling in his head. If Chaney, by some fluke of chance had managed to seal himself inside the hold then he was trapped.

"Roger. I sincerely hope that you're wrong. Because I'm about to kill a very lucky man."

With a grimace, Borland jammed his finger down on the switch.

When the hatch was open, we drove into the hold and sealed it behind us.

Chaney was not inside. His death would not be on our necks, at least. His tomb was forward, in the bow.

But although Chaney's luck had deserted him, ours had not. The reactor was still intact within its shock cradle. The ready light was a green beacon of hope shining on its massive, lead-sheathed flank.

"Good!"

Borland's single comment spoke of untold relief.

"Kid, cycle the chamber. I'm getting out. We'll have to tow the reactor to the mine site. I'll rig the sled cables. You remember how to drive a crawler, don't you?"

I gave him a slight nod, irritated that he would have thought that I would have forgotten such a thing. Did he think he was the only one in this crew with a brain?

"Fine. We have very little time. The Station will be calling us for a progress report. Let's not let them down."

"I've a better idea," I said slowly.

Borland looked at me sharply, his black eyes glittering in the overhead glare of the crawler's cramped interior.

"What's that?"

"Let's not let ourselves down."

He stared at me a long moment, his hard face expressionless. Then the corners of his mouth broke into a smile.

"Okay, kid. Good enough. Now, get me some air. I can't breathe the poisonous soup this planet considers a healthful atmosphere."

4

We were down and Venus was ours. Almost....

The next five hours were a blind race against the devil himself, with all three of us working until we were ready to drop. We didn't even stop long enough to think about food.

The gliders had come down on a broad basin of rock and dust broken in

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its unrelieved flatness only by a single low mound of native rock the geologists had named Mount Thor. To my judgement, Mount Thor was scarcely more than a hill, and a pretty pathetic one at that. It's summit rose not quite 300 feet above the level of the plain, and the rise of its slopes was so gradual that one hardly noticed the climb.

Nonetheless, this was home.

We would bring our glider up onto the north slope so that the bore could begin its work of cutting the first shaft. Once this chamber was completed, we could carve out the portal for the airlock and start to excavate the tunnel networks. The bore's laser assisted bits could eat their way through any rock known to man, and the machine's guidance computer and program tapes allowed it to operate with minimum supervision. That was fortunate for us, for we had the absolute minimum of personnel.

The single intact glider was our base. The reactor was on a sled by now and moored to the stern of the glider by tension cables. Chaney's glider was useless, it could not be moved. But Borland was camping out in its hold, using our crawler to get back and forth.

I didn't mind in the least. It let me be alone with Beth. I knew it was only a matter of time before the girl and I were curled up in the rack.

But first, there was work to be finished. Until we had the first courses of the mine dug and the airlock installed we would be living on a short fuse that was getting even shorter with each hour that passed. No time for fun, not yet. Survival dictated that. And I was still in that great god's grasp.

Girls were for dessert.

The bore needed some initial work before it could be activated. The preping required several hours. Then I had to spray on a protective layer of liquid teflon to seal the outer casing. It was hot in the hold of the glider, and the filter mask was chafing my face raw. I finished the last sweep, finally, tossed the spray canister away and flopped onto some food bins, my coverall drenched with sweat. I was flat out tired. It was time for a nap.

Unnoticed, Beth had come into the hold. I didn't notice her approach with my eyes shut. She began brushing my forehead with a damp cloth. It was cool and wonderful. Then it went away.

I opened my eyes.

"Don't stop. It feels good."

Beth laughed and smiled.

"I'm not going to spoil you, not down here. It will be years before anyone will be fool enough to call this place home."

"What's that matter to us? Live one day at a time, the future be damned."

"That was how you used to live, wasn't it? One day at a time?"

She was looking right at me, eyes large and brown. Pretty things. A man could get lost in them if he were crazy enough to give in and let go. That was the fatal mistake with women, letting them know that they were important to you. After that, it was all up. They'd take you for all they could, then dump you and go hunting another wide-eyed jerk with just a lit-

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tle more of what they wanted.

"That was the only way we had to live. It worked, so it wasn't wrong."

"That's why you killed?" she asked quietly.

"No! I killed because I enjoyed it. The others hunted me, I hunted them back. I was better. I lived. Maybe we were all animals, I don't know. What's the difference between a man and an animal?"

"A man has a future that he works toward," Beth told me. "An animal just lives through his days as he finds them, without making any changes."

"Glib, very glib. Somehow I was sure you'd have an answer. Well, I guess we were animals, then. No future in the ghetto. You need jobs and money to build a future and we didn't have any work. There really wasn't any, unless you wanted to hire out to the Mob as a dealer, or enforcer. Pimps were also Big Time, big industry. They had the money, the wealth. The little ones looked up to them because they were successful, and there wasn't much success in our territory. You ate when you could, played when it was safe, and grew up as fast as you could. One of the creeps I smashed was growing up as a junior hitman for the local dealer. We knew all about him. He wanted to become a full-time Mechanic, move to Chicago where the action was better. He enjoyed killing, I guess he had to since it was going to be his profession. Had his own gang, and he was *mean*. Rotten mean. I knew some bad characters on the street, and most of them were afraid of Clive. That was his name, Mad Clive. He'd killed some fast doll the week before because she was holding out on some of her action. That was the story, anyway. Probably just wasted her for fun, though. Messed her up terrible. That's where I got involved. We had our own moral code in the streets and Clive had violated it. My girl wanted us to go out for revenge since the dead doll had been a friend of hers, one of the really good ones in the stable, so we went out for a little blood.

"But things got rough, rougher than we had expected.

"We spilled blood, all right. Lots of it . . .most of it ours. Then I found the pipe lying in the gutter. Someone had dropped it and run. But I wasn't no runner. I waded into the pile again and started breaking heads. Started having too much fun, though. Stopped paying attention to my surroundings.

"The copters came down on a vacant lot a block away and before we knew what was up we were surrounded by Feds. From there it was a short trip to the Tombs and an ancient cage."

I gave her a vicious grin, savoring my resurrected badness.

"So keep away from me. I'm trouble, a bad apple."

Beth pursed her lips thoughtfully.

"If you were really as worthless and rotten as you try to let on you wouldn't be here. The Foundation takes certain categories of youths out of the Federal Relief Program, but the bottom of the barrel gets disposed of, quietly and quickly. For some, reha-

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bilitation just doesn't take. They're a danger to society and with the population being what it is we can't afford foolish mercy. The maximum prison sentence is five years in a rehabilitation center. For the serious crimes there is no prison. Killers get put to sleep. Act like a worthless, vicious beast and society will treat you like one. This isn't the good old days where fifteen year old butchers got five years and a kiss on the cheek while they learned how to become even better killers behind escape-proof walls."

My grin was changing into a smirk. I had heard all this before.

"Is that so?"

"It is." Beth slapped the wet cloth across my forehead again. "You killed, but someone must have spoken up for you. There must have been evidence that you wanted a chance to make something of yourself. Your intelligence was on your side. The stupid ones get axed right off..."

"Well, isn't that nice. No dummies allowed at the Big Grand Foundation. This is a very exclusive club reserved for Smarties. Play the game and be good and you'll get a lifetime ticket of slaving and risking your neck for the blessed Foundation. Big deal!"

Beth looked confused.

"What's the matter with you, Roger? I'm not trying to put you down. What's wrong with playing along with the Foundation? Their goal is to build a world and we're all working toward that end."

I wiped the cloth from my face and knocked Beth's hand away when she reached for it a moment later.

"I'm tired, and I'm also sick of hearing all this baloney about how good and true the Foundation is. Isn't there something else that you should be doing other than lounging in here grabbing air with the hired help?"

Her eyes were telling me that I was a pig. It was a cold stare. I'd hit a nerve.

Well, women don't like weak men. Knock 'em around and they'll love it even more when you're nice to them.

She flounced off. The hatch clanged shut with a dull sound behind her.

The cloth lay on the dirty deck, forgotten.

I snatched it up and draped it across my forehead. It still felt good. Maybe because I was doing it for myself. That's what I liked: independence. Lots of it.

The Foundation wanted to take that away from me, and that was why I hated it so. The Foundation was a cruel giant with a big foot on my neck. Years ago, the ghetto had been that giant. But I had learned how to make my own way there.

But the Foundation was a more difficult adversary. It was smarter, had a lot of money, and money means guards to keep you in line if you start thinking the wrong thoughts.

I stared up at the overhead, the struts and framing of the upper hatch with the big lights shining down at me.

What was it Beth had said?

"Animals don't have a future because they don't try to make one." I said it aloud. The echoes bounced around the empty hold. Was I an

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animal? Did I even want a future?

The day dragged on after that. Beth was less talkative. Certainly she was a lot less friendly. But I wasn't worried. There were only two men on this planet, and I had it over Borland nine different ways. She would come around on my terms when I wanted her.

Beth and I worked long into the 'night period,' and we could do no more. We were in Chaney's wrecked glider, salvaging what we could from his load. Borland had sacked out in the hold, leaving us to make do in the crawler. The situation had possibilities, but I was almost too tired to eat. Beth would keep. As it was, I fell asleep on the deck with the half-empty food container still on my lap.

The interior of the crawler's cabin glowed with pale green illumination intended by the designers to be restful. Beth was still asleep. I watched the rise and fall of her body beneath the thin plastic cover.

Why was I awake?

It seemed a reasonable question without an immediate answer. I crawled over to the bulkhead and placed my ear against the insulation. We could not forget that we were alone in a very inhospitable place. Was there a faint trembling in the wall material?

I stood and pulled on my coverall with a burning desire to look at the radar screen. We had been lax.

Leaving the crawler, I shook Borland. He was exhausted and grouchy.

"What's the matter?"

"I'm going over to our glider."

"Why? Something wrong?"

"I don't know. A feeling..."

"Street fever, huh?" He grinned up at me, pawing at the 'sleep' crusted in the corners of his eyes. "Relax, kid. Nothing's going to happen to us down here on the surface. It's up in the atmosphere that you have to watch out for storms and turbulence."

"I want to check the radar," I snapped back at him.

Beth was up, now. She poked her rumpled head from the crawler's open hatch, her eyes red-rimmed, and watched us argue.

We had managed to get the airlock working in Chaney's glider in the last few hours. I think it was that fact which made Borland make the decision to stay. He practically ordered me out, with the condition that I let him sleep. He would curl up in the airlock. I was to wake him on my return.

Exhaustion can do funny things to a man's judgment. We both thought the other was an unreasonable fool. But Borland was firm in his refusal to accompany us.

I say us, because Beth insisted on going along. Ripping a portable transceiver out of its clamps, I tossed it at Borland. He caught it awkwardly, clasping it to his chest.

"Very well, we'll leave you. But keep an ear to the radio. Please."

"You're losing sleep for nothing, kid. And I won't be your nursemaid."

He vanished into the lock and slammed the thick door on us. The clips levered themselves up into locking position and abruptly it was very quiet in the hold.

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There was nothing to do now but to leave.

The outer door of the hold tilted outward and I drove the crawler out. The cloud ceiling was invisible in the gloom, but on the far horizon lightning played in the darkness, white-hot and jagged.

We drove to the glider in silence.

Was I being foolish?

I felt the first twinge of self-doubt. Perhaps Borland had been right. There was no tangible reason to be worried. Still, there was the feeling. It had played me fair before, even saved my life once or twice.

There was another question, too. Why had Beth insisted on coming along? She wouldn't talk, but only sat by one of the TV consoles and stared at the near-night of the Venusian day.

The crossing was uneventful. I guided the crawler into the cargo hold and started the lock cycling. The electric motors of the crawler whined down to silence as I cut the juice from the fuel cells.

I unstrapped, tossed the restraining belts into their hooks, and started to get up.

"Wait."

Beth touched my arm.

"What I said to you earlier . . . it was dumb, judging you by my standards, not standards you grew up under. I love you. Can you blame me for wanting to remake you into my image?"

The restraints clinked on the deck as they fell away from her body. Moving toward me, she took my face in her cool hands and kissed me.

That should have been paradise. It was just what I had been wanting all these days. But there was something in the way of my enjoyment. A cold pang drummed in my heart. Without thinking, I thrust her away.

"There isn't any time for this," I almost stuttered. "It's crazy. I've got to look at the radar."

Beth was already pulling at the fastener around the neck of my coverall. She was nuts!

"No!" I pushed her back, shoving her down into the empty couch. My steps took me toward the hatch.

At first Beth gazed after me with a hurt expression on her face. She didn't understand.

Hell, that made two of us.

Then a redness suffused her features and her lip curled.

"Dumb little punk," she shouted at me. "You don't know what's good!"

I didn't have an answer. Not then, or now.

With her being dead, I guess it really doesn't matter.

Sitting before the radar, fingering the knobs nervously, I watched ghost images build up on the screen. The surface features were dim. I set the scan so that the echo of the cloud canopy would be filtered out. A bright overlay of haze vanished, leaving behind a glowing snake that came twisting down from one corner of the screen. Smaller snakes were in attendance, and all of them were dancing.

I couldn't begin to imagine what they were, but I felt myself growing cold inside again. The feeling was

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there, gnawing away, warning me.

I ran to the radio and began calling for Borland. After a moment, his sleepy voice came out of the speaker.

"What do you want, kid?"

"There's something registering on the screen . . . an atmospheric disturbance of some sort. They're on the limit of the screen, but coming this way, and fast."

"What are you talking about?"

"Maybe tornadoes. Simpson, the meteorologist told me before we left that his crew had lost some surface probes to a mysterious storm phenomenon while they were mapping Satan's Basin. The tapes suggested tornado-like action, but he wasn't sure. We've got to get to shelter, or else run."

"Shelter!" Borland laughed. "Kid, I'd like to see you try to scratch a hole in this powdery soil. You could dig all night and make nothing better than a twenty foot wide crater. The dirt just doesn't hold together."

"Then we should use the bore."

Beth had slipped into the control room unnoticed.

"Too slow," Borland told her. "Couldn't dig a safe shelter in this unconsolidated soil, anyway. If you're right, if you are picking up tornadoes, you'll have to run, or stay where you are and trust to luck. The odds are better that they'll miss us entirely. The crawler is too slow. But one of the gliders running on its turbines should be able to keep ahead of them, or dodge as they pass."

I seized the mike.

"Right, we'll pick you up."

Beth was looking around confused.

"Get Borland. I'm going to start the turbines."

After a moment's hesitation, she moved to obey.

I ran back to the radar. The 'snakes' were nearer. They were definitely approaching our way.

The glider was constructed on the principle of an air foil. It could descend in a controlled fall, fly in a ponderous way, and move along the ground like a sled when its two auxiliary guidance turbines were operating. The range was limited by the amount of oxidents which we carried in the aft fuel reserves. We weren't equipped to make a lengthy run.

Oxygen and hydrogen combined in a gaseous rush as I fed the firing chambers and started the finned rotors turning. Triggering ignition, I waited as a whine began to build.

On the overhead screen the stern cargo lock door slid open.

Where was the crawler? Beth should have been halfway to Borland by this time.

I started a sweep of the horizon with one of the remote cameras.

Blackness.

A network of high-intensity flares screeched from their launchers and spread out above in a canopy before exploding. The steady, piercing light showed me twenty square miles of landscape, and I could not help whistling between my teeth as I backed off on the magnification.

The cloud canopy was pulsating like the underbelly of a living creature.

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The flares had painted it a fishy white. Trailing from this churning membrane of cloud were seven twisting whirlpools. A silvery light filled their cores. Lightning was dancing within the interior of each of the funnels. Only one was actually touching the surface. Here, a storm of thrown debris and a constant flickering of lightning boiled up. Nothing we had could live through that kind of treatment.

The nearest funnel was only five miles away, and jerking toward us in gigantic leaps as though it were a vast, booted foot determined to smash the glider into the dust.

"Beth, hurry. We don't have as much time as I thought."

I remembered how her frantic voice had come back over the speaker.

"Roger, I can't get the crawler to start. It's shorting out. I can smell insulation burning. I'm afraid to go out on the surface with it like this. If it seizes up I'll be trapped."

"Damn." My fist thudded against the console before me with rage.

The turbines were up to full strength, now. They moaned in my ears like the calling of twin banshees. That was an appropriate term. Banshees only called when someone was about to die.

On the screen the broad, cloud wrapped foot of the funnel was sweeping toward us. Behind it, two more of the twisting tubes of whirling air had smacked down on the surface. They played over it like hoses, sucking giant ditches into the soft surface.

"Close the airlock, Beth!"

I wondered that I could sound as calm as I gave the order that would surely cause Borland's death. Perhaps civilization was taking. Before, I would have ordered the hatch closed without a single thought. If Borland died, it was his tough break. No skin off my butt.

Borland had been eavesdropping on the comm-circuit.

"You leaving me, kid?"

"Crawler's gone bad...no time to fix it. I'm sorry, Hal. Tell me to do something else, something that will save us all, and I'll do it. I can't say that I want to do this."

The glider was beginning to move. The throttles slid easily under my hands. The turbine whine rose to barely detectable limits. My feet shoved at the rudder controls. They squeaked. I was sending us north, at an angle calculated to take us away from the approaching funnel clouds.

"Okay, you're a bastard. So much for formalities." Borland laughed again, his voice rasping strangely. "Don't fret. You're doing right, kid. I'm a lunkhead for not listening to you. But those funnels won't come within a mile of the camp, I'm betting. Take off. See that Beth's safe. She's a good girl. A real *good* girl. Don't forget that, kid."

"Sure, Hal. Take care."

The glider was still gathering speed. We headed out into the featureless desert. Behind us, its protective sheathing gleaming dully in the glare from the flares, the reactor bobbled at the end of its tow.

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The storm, or storms, however you wish to identify a multiplicity of dangers, rushed past the glider rumbling like several archaic freight trains. Gravel splattered across the hull like hail, and the glider shuddered and almost left the ground, sucked aloft by the vacuum generated by one of the nearby funnels. Then they were past, thundering off into the gloom-ridden distance.

Gradually, the desolate plain became still once again.

We circled back and sought to relocate the other glider, Borland's sanctuary.

An hour passed.

"It's gone," Beth said finally.

We had been crossing, and recrossing the same area over and over again. There was nothing, not even a loose scrap of metal.

"He's dead, just like Chaney. We can't waste any more time looking for his body. We're down here to establish a mine. Let's do it."

"And if he's lying somewhere trapped in a wrecked glider waiting for us to rescue him?"

"He's not. You know that as well as I do. You just won't admit it."

Beth advanced on the map strip and dug a fingertip into the glossy surface.

"There's Mount Thor. Turn three degrees to starboard and we'll be in position to start operations. We have our lives and a job to finish."

There was no other argument to make. So, we did it.

It took a week—an Earth week—for the bore to carve out the first level of the mine. The bedrock here was a mafic igneous mixture that was hard and rich in magnesium and iron.

We used the grapplers on the crawler to mount the airlock. This was the hardest part of the entire mission. The airlock was huge, and awkward. It had to seat perfectly so that the epoxy sealant could lock it into place with the smooth cut stone of the walls. The crawler broke down twice during the mounting. Electrical failures! But Beth and I were growing into a well disciplined team. It was almost as if we could read each other's minds.

There were a few arguments. But they didn't last long. Just quick and furious outbreaks of temper. When they were over we both felt better and were soon engaged in making up. That was fun.

It was then that we realized that we had fallen in love. It wasn't exactly romantic love. We were simply the only two human beings on Venus. The relationship was probably as much a product of necessity and environment as it was free will on our part.

But it was enjoyable. We were living for each other. Venus was still hell, but we had wrought a tiny image of paradise within the pit.

Once the airlock was mounted and functional I used the crawler to install the life-support system. The reactor had already been dragged into one of the side chambers and activated. We had light, beautiful, white light glowing down from the raw stone ceilings. Perhaps it was garish and cold looking, but any illumination was welcome

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after the perpetual gloom of the surface world.

Power cables snaked across the rock floors. Later, we would dig channels to protect them. But for now they would have to be exposed. We had neither the time nor materials to do a proper job of fitting up the mine.

Topside, up at Venus Station, they had deemed our experiment a success. Congratulations were followed with the announcement that the airbus was being fitted up for a descent. The Blue Crew of the mine would be sent down just as soon as we were ready for them.

But first, the interior of the mine would have to be sealed.

That involved spraying the walls with a quick-setting plastic. There could be no seepage through the porous stone. That would mean attack by the corrosive atmosphere. The air would gradually become polluted and deadly.

God, but we worked until we were ready to drop. Looking back, I don't understand how two people could have accomplished as much. Even with four, as the plan had allowed, it would have been killing work.

But somehow, we made it.

When the air tested out as GOOD, we ventured for the first time out of the protective womb of the crawler. The machine was shot. We never used it again.

The main room was glary, hot, and reeked with catalyst fumes from the plastic wall sealer. But it seemed like a vast palace to us after the cramped quarters of the crawler.

Beth was enthusiastic as she bustled about the interior.

"I'll set the bunks up over there, and the kitchen facility can go here, right in the middle of this alcove."

I had to laugh at that. Leaning against one of the walls with an empty ration sack beside me, I was resting for the first time in days. The wall behind me was warm, and the steady wail of the air conditioner was something we were getting used to, a necessary evil. Everything was going well, it seemed.

"You sound like a housewife," I kidded her.

"The first housewife of Venus," Beth repeated to herself. "You know, I could get to like a title like that."

"I thought you were the professional type?"

"I'm still a woman. Maybe I'll become domesticated."

"Impossible!"

She came over and sat down before me, crossing her legs and letting her hands trail in her lap. They were red and worn with the labor of building the mine. I found myself wanting to heal them.

"You remember the story of Adam and Eve, don't you?"

I laughed.

"Now I know you're a crazy woman. Tomorrow the airbus will be down with the first load of supplies and equipment. This place will fill up with technicians and miners as they begin to open the mine. And then we'll just be Roger and Beth, again."

"Just Roger and Beth. Doesn't that

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make you just a little sorry?"

She was probing my feelings with her eyes. And I didn't even try to fight it. We had already opened up to each other. We were one in body and spirit by that time.

"As sorry as I'll ever be. But I've heard that the nights are long on Venus, and they can't send down the airbus until we give them a weather clearance."

Beth grinned and touched my knee.

"I was hoping you might say something like that."

5

The first airbus brought more with it than just supplies and technicians. Riding along were reporters from all of the major World Communications networks and several high officials of the Sayre Foundation.

Beth and I were the heroes of the moment, and Borland and Chaney were both martyrs of the highest order. A monument to their memory was set in place just within the valves of the airlock. It was a bronze plaque with reasonably good likenesses of the two men and the words:

KEEP ALWAYS IN MIND THOSE WHO HAVE GIVEN ALL THAT OTHERS MIGHT PROSPER IN THE NEVER-ENDING STRUGGLE FOR PROGRESS.

Brave words. They made a fine shroud. The remains of Chaney and Borland were never found, Venus had accepted them to her bosom. A goddess requires sacrifices in order to gain her favor

And that favor, if favor it was, seemed to be given grudgingly.

Everyone could not help wondering at the hellish conditions existing on the planetary surface. It was nearing sunset. Several Earth months would elapse before that event actually occurred and the sun vanished behind the horizon. But already the desert was touched with the colors of blood.

Within hours after the landing a nest of funnel clouds sent some exploratory crawlers racing for the shelter of the mine. Mount Thor was situated in a 'Tornado Alley.' But it made good videotape, and the home offices were well pleased when the viewing ratings came in the following day. This was the biggest thing since the opening of Lunar Base One.

Venus was the impossible planet that no one would be able to tame. That was the scientific opinion.

The Sayre Foundation was determined to prove that opinion wrong.

Another, even larger, bore was offloaded from the airbus and transported to the mine. The technicians had it set up and running in less than an hour. They excavated a new gallery and then sent the bore downwards, into the basement rock of the planet. A second level was formed and an airlock installed. Side channels were dug, and all three underground openings were linked. Chemical smelters would be constructed within the largest void, where the slag and till could be easily transferred to the surface.

Eventually, news waned, and the airbus departed. It returned with a sec-

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ond exterior strength airlock. The work progressed swiftly. But I began to find myself more and more at loose ends. All of the technicians were professional miners, and I had little training in the field. My job had been to open the first run, and I had been given it only because I was expendable.

Whoever said kamikaze pilots were obsolete?

I wasn't even a hero anymore. And Beth was almost always too busy to spend much time with me. I began to wander the cut passages aimlessly on my off hours, ducking out of the way whenever oretrucks came moaning out of the darkness.

It was on one of these undirected tours that I happened across Forsyth.

The geologist and I had met briefly before at his arrival. I found him picking at a discoloration in the strata exposed in the roof of the tunnel. Drift 3 lay deep under the mountain, and although the ore body had ended fifty feet back, the tunnel had been extended to gain more data on the nature of the planetary crust.

When I saw Forsyth's light, my first impulse was to turn and slip away before he noticed me. But a loose stone turned under my heel, rattled, and betrayed me to him.

"Hello, Roger. Thought I was all alone down here."

Forsyth slid his rock hammer back into a loop on his belt and rubbed with his thumb at the slab of rock he had pried out of the ceiling.

"A rather odd inclusion considering the nature of this formation. This

area was turned upside down about four billion years ago. What had been a surface formation was buried deep and forgotten. Judging from the weathering on the rocks, Venus was a healthier place, then. Her atmosphere was thinner. I want to investigate further, but the Foundation is being cautious. They want the mine making a profit before they plow any more money into research projects."

Forsyth held the rock out for my examination. It was a rounded lump of granite. Pieces of powdery sandstone still adhered to it.

"See the significance?"

I didn't, and shrugged.

"I've got to be going."

"And just where might you be going down here?"

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"Just going, that's all." I turned and began to walk up the tunnel toward the light stringers.

Forsyth trailed behind me, not speaking. The beam of his handflash danced across the rough stone of the tunnel walls. He turned it off as the first overhead light came up.

Finally, he spoke.

"I'll be going back up to the Station on the next bus. What's been discovered down here on the surface has provided the stimulus for a new upper atmosphere research team. I've been asked to join, though I'm not sure why they feel they need a geologist on their staff. The clouds are thick, but there aren't any rocks buried in them. At least, I don't think there are.

"Anyway, this group wants to try to colonize the cloud layers. They say it's too damned hot down here."

I had been in the clouds, before.

"What about the storms? I've come down through them. I know what they can be like."

"Yes," Forsyth acceded. "Problems do exist. But having reviewed the proposal I can't see that the problems they must deal with are any greater than those with which the mine has overcome. It isn't clear as yet which effort has the most promise. Some feel that we should stick to automated surface machines, even for mining. That's possible, given the sophistication of remote guidance technology. As for living in the clouds, we have some good heads on the team. Answers might be found if we try."

We walked along in silence for about fifty feet or so.

I wasn't sure what Forsyth was getting at. But I had a hunch he was about to ask me to join something.

"I'm a convict," I reminded him, before he could stick his neck out.

"An ex-convict. The Foundation has commuted your sentence. Heroes cannot be criminals. Destroys the image for the young. We had to clean up your record for popular consumption. Your past is behind you as long as you want to keep it there. If you don't, well, that's your affair."

"You're trying to talk me into something, Forsyth," I snapped.

He grinned.

"Yep. That's a fact. We want your name on our project. It might lend some weight to our argument if we have the backing of the first man to land on Venus and live. You have a lot to offer. Surface experience, a sound native intelligence, and even better, a knack for survival. All you lack is an education. And that's why I want you up at the Station. You will require a degree if you're going to amount to anything. Class work can only complement your skills. You can go far if you'll just let yourself."

I started laughing.

"Just like that, all of a sudden I'm a clean guy. Amazing what public opinion and a piece of paper will do. Well, I'll tell you this, Dr. Geologist Forsyth. I'm still a convict to the people I've been working with. I'm only clean to the big boys, the ones who don't have to live with me. The other guys, they know what I am."

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"You're a kid who grew up rough. But you aren't going to remain a kid. Sure, you can stay down here on the surface as a truck jockey and maybe get yourself killed in a cave-in . . ."

"Or I can go up with you, study and get smart, and maybe get killed in an acid storm."

Forsyth gave me a slap on the back. I staggered under the force of the blow and stumbled, almost going to my knees. Whirling, I got ready to deck the good doctor. He was just standing there staring at me. I hesitated, still in a crouch with my fists clenched.

"A month ago you would have been all over me by now. You're learning, kid. Someday, if you're not careful, you're going to be just like the rest of us. Civilized. But I won't play any more games with you. I said you were smart, and you are. Think on what I've said. If you want to go there'll be time to see me before seventeen hundred tomorrow."

Abruptly I found myself alone in the hard glare of the overhead stringers.

"Crazy old man," I muttered.

But when I went back to the cubicle, the empty cubicle, I did just what I had sworn that I wouldn't do. I thought about Forsyth's offer. And as much as I fought it, the idea began to look good.

Beth was eating when I found her. The kitchen area had expanded to an entire room. The dining tables were rough cut slabs of stone levered into place on pedestals. We were nearly alone. There was only one other group near the door and they were busy with a discussion on how best to open a new deep level.

She smiled as I took her hand.

"I'm leaving."

The smile slipped and fell in on itself.

"What?" She put down her fork, losing interest in the food before her. "What about our plans? The things we've promised each other?"

"They're still valid. But they're going to have to wait. At least until I finish school. I've been thinking. Sometimes that's not easy, dreams get in the way, muddy up reality and make you see things that you want to see, instead of what's really there. I'm doing okay, now, but I won't grow much at my present job level. The problem is that you *will* grow. You have skills, and a degree, besides. What have I got?"

"You've got me."

I kissed her for that. Slow, and lingering on the lips as though she was the only other person in the room.

"That means more to me than you'll ever know. And that's why I'm going back up to the Station. For you. You'll like me better when I get back from there."

Her eyes misted and she looked away.

"You're just using me as an excuse to do what you please. That's an old line. I've heard it before."

She pushed away from the table and ran out of the room.

I called her, but she wouldn't stop.

Later, Forsyth was full of answers.

"You can talk to Beth by radio once

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we get back to the Station. She just needs a little time to think, just as you did. Come on."

Glumly, I let myself be led away.

That was the last time I saw her. We never got that opportunity to talk again. That hurt the most.

Now she was dead. It was all over.

6

The equipment transporter trembled as it slid into its receiver. Locking bolts whirred out to seat it in its docking channel. Home again! But home was getting a little threadbare.

Yanking off the elastic restraints, I shoved myself out of the unpadded seat and kicked toward the green ringlight of the airlock. Dennis Parris followed towing a bulky camera case behind him. We had been doing photo workups on the construction docks. If the shots were good they might actually end up as illustrations in the Foundation prospectus which was distributed yearly among the top ten financial powers on Earth. The Foundation needed billions each year to stay in operation, and speculative contributions prompted by the prospectus kept it going.

Once inside, with air throbbing into the lock chamber, I removed my helmet and checked the housing over the radio. The plastic was unmarked.

"No damage, blasted thing went out by itself...third time this week. When's the Foundation going to get us some decent equipment?"

Dennis was stripping off his bulky outer suit. He favored me with a sour expression, as if to say: 'what are you complaining for, anyway?' He shrugged.

"Jake told me they identified the bodies from that transporter smashup we helped clear last watch. It was the Cussler brothers, both dead... guidance system went out on them. We're not the only ones putting up with worn-out gear. We've just got more luck. It's a good thing the Foundation is making money."

"Then why no replacements? They want us dead? It's only a matter of time before we run out of luck."

The conversation dragged on as we left the chamber and took the elevator down. Our weight began to seem normal again as we neared the first ring. Down here, the main corridor was busy. Everyone seemed to be headed in the same direction. Jostling into the crowd, Dennis and I joined the flow.

Then I spotted a familiar face.

"What's the hurry?"

"Grades are posted on the Big Board. And everyone is graduation happy."

Gifford waved 'good luck' and vanished into the crowd.

Graduation! Had it been that long?

The noise level grew as the corridor emptied into the Station's dining area. But no one had food on their mind today. The board mounted on the bulkhead behind the podium was mobbed, with no way to get close to it. Dennis, after a nod of resignation, disappeared into the sea of bobbing heads.

There was an empty table off in a sheltered corner of the room. I moved toward it and sat, propping my feet up on the greasy top.

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I looked calm, I suppose, but I didn't really feel that way. This was the final test of competition. Fifty percent of the enrollment were convicts, or ex-convicts, like myself. The others were the elite. Their way out to the Station had been paid for by their families on Earth, or by government grants. That was where the differences lay. They had been trained to study. I had to learn that skill the hard way, while trying to pound physics, meteorology, chemistry, and biology into my thick skull. Just like putting square pegs into round holes. I had to force everything. And all the while, there had been a full work schedule. Venus Station was not an elite university, but rather the point of focus for the growth of a new colony. The students were there to work. School was a sideline created only because everyone was getting a benefit from the extra training.

The catch was that if you failed at your studies there would be no further chance for advancement within the Foundation. You were frozen at one skill level unless you left for Earth, Mars, or Luna. Perhaps there you might be needed more. But here on the Station, educated bodies were in endless supply.

In groups, or one by one, I watched faces I knew well rush past. Some were leaving. They had seen the board... and their future. That was either more school, higher level studies, or more work, as they applied their new skills. Some were beaming with the radiant happiness that only success can bring. But several were crushed. Their hopes had exceeded their reality.

Dennis burst abruptly from the back of the crowd, saw me at the table, frowned and went off in another direction.

Now what was that supposed to mean?

I drummed my fingers on the tabletop nervously. The crowd was thinning. There was no longer any excuse not to get up and examine the board for my name. Behind it would be the telltale grade ratings, and maybe the gold disk that signified graduation with honors. There wouldn't be many of these. Yes, I really should be getting up. The tension would only get worse the more I waited.

Then a hand descended unexpectedly on my shoulder. I whirled about and saw Forsyth.

"You're very cool about graduation," he said quietly.

"Hello. Sit down, why don't you. And I'm not calm. What you see before you is a basket case of frittered nerves."

The geologist laughed. Then he held out his hand.

"I've a cure for that. Congratulations, you came up fifth in your division. Smyth has raised your job rating by six grades and assigned you to our project as a research assistant. That's not bad for an ex-condemned street punk, now, is it?"

I took the proffered hand and gave a firm, slow shake as reply. If anyone but Forsyth had called me a punk he might have lost the ability to speak at

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all. But I knew how Forsyth intended the words. From him, they were more of a badge than an insult.

"I'm sure you didn't have anything to do with Smyth's generosity."

Forsyth's seamed face split into an open grin.

"Anything's possible." He pushed away from the table. "We're having a group party in honor of the newly graduated assistants. It will be a good opportunity to get to know the rest of the staff. Science is still forty percent work, and ten percent politics."

"What's the other fifty percent?"

"Money, my lad. Lots and lots of money. Research does not come cheaply."

Before showing up at the party, though, I felt obligated to look up Dennis. He was in the cabin he shared with two underclassmen. They were out. It was well that they were. Dennis was in a rotten mood. He had failed to graduate. That left him with another year of study staring him in the face, and a loss of prestige.

I studied the grade printout.

"You came damned close, ol' buddy. Next time you'll have it for sure."

He grunted and took another drink of something clear and lighter than water that was sloshing about in a plastic flask.

"I may not live to next time." His words were starting to come out slurred. "Evers is dead. They fished him in five minutes after we left the construction dock. LS failure. Suffocated right there in front of everybody and there wasn't anything they could do about it except watch. It's criminal. Out and out criminal. And we sit playing this silly school game, as if it meant something."

"The pay goes up," I said, knowing full well how inadequate it was as a reason for what we had been going through for the last year.

"And just where do we spend it? The Feds on Earth tax half of it away before we ever see it. The rest goes into a bank account that I may never live to make withdrawals from." Dennis slammed a fist into his bunk, making dust explode about him in a cloud. "God, I may be the world's richest corpse. Just too dumb to know that I'm dead."

He tilted the flask again and sucked at the nozzle. The inlet gurgled as he drained it.

"That won't help."

"Nothing will help, jerk. Now get the hell out of here!"

The flask sailed toward my head, and bounced off a wall as I ducked out of the way.

I left him to wallow in his self-pity. But the next work period he'd be up again. I knew that much, even if I wasn't a psychologist. I'd done some wallowing in that same mire during my first semester. By now Beth was just a memory. Time had faded the intensity of my feelings. But I still missed her. She was a gap in my life that I could never fill.

The drinks were too sweet.

The process was unauthorized, but that had never prevented certain members of the chemistry section

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from brewing a potent distillation of fermented starch and strawberries. The sealed flasks were always in demand whenever there was to be a party, and known all over the station as 'Stanley's Pink Fire'. No one had figured out who Stanley was, or why his name was linked with the drink.

There was a round of mandatory introductions which I could not escape. Most of the staff I already knew on a limited basis. There had been field trips with them at intervals, a gradual breaking into the group which gave everyone the chance to evaluate my performance. When being assimilated into a research group, it is important that you fit...that your thinking meshes with the director and the others. If not, you'll only use up valuable time dragging your mental feet as you fight for your own way.

Forsyth's group did not want to take on a prima donna.

Well, in that they were safe. I was grass roots all the way. Just as 'earthy' as all get out.

As soon as it was politic, I slipped away to a quiet corner where I could watch the party progress and scan the interior of the lab, filled with some interesting pre-production models.

The largest model was shaped like a fat disk. It was suspended from the ceiling by cables. I was examining the underside of the 'whatever-it-was' when I became aware I had company.

"Know what it is?"

The speaker had a slight Australian accent. He introduced himself as Dr. Waverly Hanson. His field was atmospheric physics.

"Haven't the faintest idea."

"It's a test craft. It will spend all of its time aloft in the uppermost cloud bank sending us accurate data on the wind currents."

"You mean it's a blimp?"

Hanson rubbed his cheek.

"It has some of the characteristics of a blimp. We can load it from negative to positive buoyancy, and back again. The jet-props give it maneuverability. But the concept is much more like a space station. The difference is that this station remains suspended in an atmosphere instead of orbiting a gravity well."

I looked up at the model above me again and reviewed what I knew of the Venusian upper atmosphere.

"It will never work," I told the scientist flatly.

Hanson looked like he was about to swallow his lips.

Obviously, he wasn't used to reactions like that from staff. Especially staff assistants.

"The first storm will tear it to pieces," I went on. "Lightning will blast open the hull, fuse the electrical circuits, stop the engines, and rip the buoyancy cells to shreds. The wind will tear at it as the wreck falls, and what the wind misses, acid clouds will etch. It is unlikely that there will be enough of your Skystation to make a decent dent in the dust when at last it hits the ground."

"Impertinent little snot aren't you?"

Now it was my turn to fall silent

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with shock. This guy was old, but he wasn't so old that I couldn't take him apart.

"You seem to savor the savageness of the Venusian elements," he finished, unaware of what was about to happen to him.

"I have a savage background," I snapped in reply.

"So I've heard. Be that as it may, I suspect you're afraid that we'll build our little toy at full scale and make you go down and try to live in it."

"I think you're pretty damned perceptive. You fat-headed scientists seem to work overtime trying to invent ways for jerks like me to risk my life. I've more than had my fill of that bull. If you want to test that flying pie tin I suggest you do it yourself. That way I can say pretty things at your funeral, instead of it being the other way around."

I split before he could dredge up another broadside.

The party was getting dull. It seemed the people were duller still.

As I moved through the maze of tables I brushed against one of the smaller models. It toppled off its base and headed for the floor.

A girl rushed to rescue it before it struck and went to pieces.

"Do you have to be so careless? We spent a lot of time putting these models together."

"Another Skystation?" I growled. She was a pretty thing, but I wasn't feeling romantic.

"A Venusian Atmosphere Condenser Unit," she growled back, setting the model back on its base. "We call it VACU. I'd tell you more about it, but you don't look smart enough to understand."

We might have traded insults further, but the girl didn't linger. She moved away and entered into animated conversation with another of the research assistants. He had been with the group.

The party went downhill from there, if that was possible. I continued to drink, and drink, and then I drank a little more...

A sharp pain began at the bottom of my right foot.

I sat up, and my head began to pound as if there were hammers thundering on my skull. 'Stanley's Pink Fire' had definite possibilities as an anti-personnel weapon.

Then the voice began:

"You're late! Inexcusable. Smyth would be very unhappy if he could see you now."

"Then it's a mercy that he can't then, isn't it?" I managed to say at last. I held my head in both hands and the pounding inside diminished somewhat. "What do you want, Forsyth? This is my day off."

"It used to be. You're in the employ of the Cloud Nine Group, now. Get dressed and we'll have breakfast. After that, it's off to the lab. We're running a mock-up through the wind tunnel today."

"I wish you hadn't brought up the subject of food..."

I couldn't finish. Forsyth stood aside as I rushed from the cabin.

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"I'll see you in the dining area," he called after me.

Breakfast was black coffee and black toast lightly smeared with butter. I avoided the strawberry jam completely. You might have thought that it was poison.

Afterwards, I followed Forsyth meekly to the lab. We could hear the wind tunnel howling its low thunder as we approached. There was a guard standing before the main door. He was armed with a 'light-thrower,' I noticed. He had teeth if anyone was to give him any heat.

Inside, the lab was all efficient confusion. This was in direct contrast to what had been going on just a few hours before. The big computer was silently storing away a wealth of data as the experiment wound on and on.

They had started without us. I wasn't disappointed.

But I was drawn to the big window of the wind tunnel, just the same. The mock-up being tested sat directly opposite my position on a slender pedestal with tendrils of colored smoke whirling past it.

"That's VACU," Forsyth explained proudly.

"The Venusian Atmosphere Condenser Unit?"

Forsyth frowned.

"How did you know that? We've been keeping this device under a security blanket."

"Well, I nearly put your pride and joy on the floor last night during the party. One of your girls told me what it was. Pretty thing she was. Blonde, well built. Probably smart, too. At least she had a smart mouth."

"Oh. That was Irene. Well, that was what the party was for, to get you acquainted with the others. I just wish you hadn't been so chummy with Dr. Hanson. He's one of the Project leaders. His opinion of you is very low as of yesterday. It might have been better for you if you had spent more time getting friendly with Irene."

"Well, we didn't do that, either," I told him. "Now then, what does that gadget do that's so secret?"

"Better to show you. The sequence is almost due."

Forsyth was watching one of the technicians standing before a remote panel. He began to throw switches, speaking aloud as he moved through a check list of actions.

Forsyth pushed me closer to the window and pointed.

"Notice the grills running about the perimeter of the model? Their covers just snapped open. . .see how the colored smoke is being sucked inside? That isn't planetary atmosphere, just pressurized cabin air, but the result should be pretty much the same. We'll know how it goes in a moment."

The smoke inside the chamber was beginning to flow in new patterns.

Forsyth was speaking again.

"When we send the first working model down it will have teflon shielding and cooling units to keep it within operating limits. This mock-up is merely a check to determine that all the internal mechanical components operate smoothly. Also, we want to

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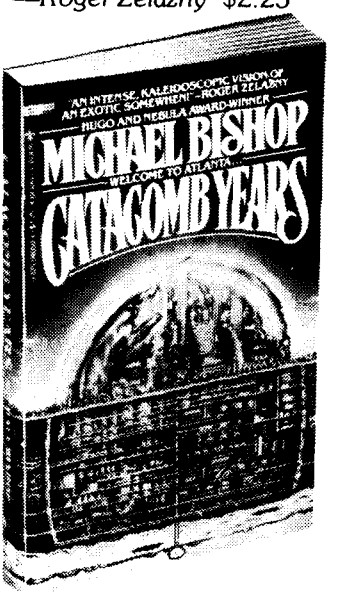

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document the efficiency of our condenser unit. You see, this device, when constructed on a larger scale, will be released by the thousands into the lower cloud bank. Each unit will have an operational lifespan of fifty years. We hope to have several million in the air at the end of ten years."

"Why?" The hangover was making me slow. I should have seen the answer at once. The reason was in the name of the unit.

"We're going to thin out the Venusian atmosphere. That's the goal. The Skystations are merely a diversion. They will allow us to colonize Venus while waiting for the surface to become livable. As it exists now, the surface is just too dangerous for extended habitation. The failure of the mining station has proved that point. Mining Station Charlie should not have been breached. There were numerous failsafes installed to prevent just that. But the station *did* fail. And we've learned the lesson."

"It was an expensive lesson," I said dully.

"For all of us," Forsyth agreed. He put a hand on my shoulder.

The model continued to 'float' atop its pedestal, but by now a pair of smoky whirlpools had formed above it and below it.

Forsyth was getting more and more excited.

"What's the windspeed, Joe?"

"Got a Force 7 gale in there," the tech read his panel calmly. "We push it up to 10 in a few minutes, hold it for five, and then go for 15."

"Venus will give your machine better than that," I said.

Forsyth nodded.

"We know. VACU has been built to take it, but unfortunately our wind tunnel and this lab have not been. Smyth would frown upon our tearing up the Station just to obtain a realistic test run."

Dr. Hanson came in to witness the climax of the experiment. He barely glanced in my direction as he passed. I shrugged and winked at Forsyth.

The tech moved the experiment up to its next plateau of difficulty. The streams of smoke visibly quickened their pace. The whirlpools began to lay over on their sides. The shriek of the wind was now audible even through the thick, reinforced glass of the window.

"Force 10," the tech reported. "My board is green . . . going to Force 15."

"Carry on," Hanson told him calmly.

The thunder deepened its note. I could feel the energy of the moving air drumming in my shoes, stirring my blood as the vibration worked through my body. We were containing a hungry tiger in a wicker cage. What if it wanted out?

"Getting a red indicator . . ." the tech began.

Suddenly, without any warning at all, the mock-up was gone, snatched out of our sight. Then we heard the monstrous clang of it impacting on the protective bars that shielded the air intake of the tunnel.

"Kill the fans," Forsyth shouted.

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In the dying whine of the artificial windstorm everyone crowded about the window.

7

"I ran that support through the laser analyzer only hours before this test," the technician told them, his voice filled with his bafflement. "There weren't any flaws, nor was the metal beginning to recrystallize. I just don't understand."

"The fact remains that the pedestal failed. The evidence is obvious." Forsyth brandished the upper half of the equipment stand and showed them again the clean, mirrorlike break two inches below the mounting bracket.

Smyth had left already. The administrator had been scathing in his condemnation. The model had required several thousand dollars for its construction, to begin with, and damage to the wind tunnel fixtures was considerable. Tiny fragments of the disintegrating model had smashed into the turbine fan blades. As a result, the turbine would have to be disassembled and new blades installed. The price tag for that operation would top the loss of the model.

No, Smyth was not happy with us. We were rocking his financial boat, the boat the entire Foundation had bet its existence on. It gave me a certain amount of joy to think of it. Perhaps, it was simply revenge for all the times I had risked my life going outside in substandard space gear.

Forsyth tossed the pedestal into the arms of the startled technician.

"Throw that junk in the scrap bin for recycling. Roger, come with me."

I could only follow him down the halls to his tiny office. We saw almost no one. Even so, rumors were already circulating. The test failure would be added to the network of discontent beginning to plague the Station.

Forsyth shut the door and waved me to a chair. He headed for his favorite chair behind the big desk.

We sat and stared at each other in silence for openers.

"You look like a man carrying an elephant on his shoulders," I said to him at last.

Forsyth sighed.

"This isn't the first 'accident' to cause slippage in the schedules. There's only so much money in the budget. To keep the schedule going we have to take money from other areas. But you can only do that so long before the system begins to break down altogether."

"And people die," I added.

"Yes, people have died, and more will. That's certain."

He gave me a grim smile.

"You never struck me as the type who worried about death, Rog."

I laughed. But not very loudly. Yes, I worried about death. All the time. It used to look over my shoulder constantly. I could have whiffed the foul, carrion scent of his breath had I wanted to. Now, the demon had withdrawn somewhat. But he was still there, waiting patiently. He did that for us all. He bided his time, knowing full well that each game would run out eventually and he would collect his

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due, his portion of soul.

"I worry about old equipment, equipment that isn't worth repairing, but is repaired just the same. I don't like risking my life for nothing. No one does. Death has to have *some* meaning, just as life."

Forsyth nodded.

"We're beginning a new fiscal year. Money has been expended toward buying new equipment. The shipment has to come out from Earth, though. That will take more time. But things will change. Can I ask you to have faith in the Foundation? They really aren't the gang of ogres that some of you youngsters seem to believe."

"You can ask me anything, old man. But I reserve my judgment until I see some facts. I learned that, not on the street, but in your college of higher learning. The Foundation is risking all of our lives. It's going to take a lot of convincing before I see the top boys as saints looking out for my welfare."

"What if the failures are being caused by something else?"

Forsyth's face abruptly became intense. His eyes drove into mine. I couldn't look away.

"What are you saying? The damage was intentional?"

Now I did look away. The idea was absurd. No one was out here but the Sayre Foundation, staff and members.

I leaned back in my chair and stared at the black metal ceiling. It struck me suddenly that the room had another occupant, a tiny spider whose slight web was strung across one dark corner. The room had seemed very cold and functional. But now, wasn't it more livable. We were sharing our living space. It was an odd concept for me, for I hated spiders with a passion. But for now, the spider, and its web dangling with the mummy-wrapped bodies of its rare meals, seemed a homey touch.

"I find it hard to believe that someone would purposely try to wreck the Project. What possible benefit would anyone get from it?"

"What benefit?"

Forsyth's voice was dry. He sounded almost as scathing as Smyth, now. I shifted uneasily in the chair.

"If the Project were to be discarded today, where would you go?"

"Earth, I suppose. Or maybe be transferred to one of the new colonies on Mars, or Luna."

"You'd like that?"

Why was he being so pushy on the subject?

"Maybe. I know how to live on Earth. And as for the colonies, life would be a lot more human there. They're further along with taming alien conditions. Luna would be a resort compared to this jail. Venus is a hell hole. I wouldn't send my worst enemy down there. It'd be kinder to cut his throat up here and kick his body out into space. Mars is heaven compared to Venus. A chilly heaven, but I'd rather freeze, than cook."

"Whatever. Hate can be a powerful emotion," Forsyth went on. "A man sometimes willfully destroys himself in order to bring down a hated enemy. Do you agree?"

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He didn't give me a chance to do anything but nod.

"Well, he does. Whether by intent, or accident, there have been failures not attributed to faulty gear. Our test just now is a good example. The pedestal *was* sound. I looked at the laser scans myself. Someone doctored the stand on purpose, hoping that it would fail."

I stood up, suddenly angry.

"And you think I did it because I'm an ex-con!"

"What?" Forsyth stared at me in amazement. "Whatever gave you that idea, boy? Of course I don't think that. But others of your particular breed are hardly so trustworthy, or intelligent. Underground organizations are part of human nature. The 'new' man always has something to rebel against. The Foundation is a beautiful target. For the 'prisoners' here, its destruction would be a ticket home to an easier, safer life. There are many willing volunteers to rush the barricades, all they need is a leader, some directing force. What *that* is can be considered the most important threat facing the Foundation currently."

"I won't be your spy."

"I haven't asked you to be. Nor would I want a spy whose allegiance is so tenuous. You'd be a double agent by the time you took two steps out that door in back of you." Forsyth grinned. "Now sit down and listen for a change, and keep that big mouth of yours shut. You never know when you just might learn something."

My blood surged hot for an instant. But then I sat. There was nothing to be gained by bruising up Forsyth. He wasn't exactly a friend, but knowing him had meant big changes in my life. As long as things kept improving I would play along with him.

"There's going to be another test, soon. This is an important one. We've constructed a prototype of a Skystation. It's flown by automatics because we don't feel like risking personnel at this early stage. Too many things might go wrong."

"The wind tunnel is a wreck," I stuck in out of rebelliousness.

"This test won't be going near the wind tunnel. The prototype has already been loaded into the cargo section of an airtruck. Everything is very hush-hush. The head of the department knows about it, and now you know about it."

"Why do I know about it?" He wasn't just being generous.

"You're the pilot of the airtruck. We're giving you William Gilbert and Irene Cober for a crew. Bill designed the remote circuitry and controls. And Irene's specialty is Venusian weather and genetic engineering. You won't need her biological talents on this trip, but her knowledge of the weather just may save your life."

"What's the point?" I snapped.

Forsyth's face turned hard. He thought I was backing out.

"Of the test?" I went on. "What are we trying to prove?"

"Survival is the point. We want to know if the Skystation design can take the stresses that Venus is going to give

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it. That's a mean sky down there. Nothing will be easy about this test. But all of your equipment is new. That in itself should bring home to you just how important we feel this test is."

I sat quietly, considering everything that Forsyth had told me. It was a big temptation to turn down. But something suggested that I play along. I hadn't been given very many opportunities to pilot the big shuttles. And they were reasonably safe and powerful. I guess my spirit of adventure caused me to give in. That, and the thought of working with Irene. She wasn't a bad little number.

"Who do I see to get the background information?"

Instead of answering, Forsyth tossed over to me a cassette and a microreader.

"Everything's in there. Schedule your departure according to your needs. And don't file a flight plan with Central Guidance until you're actually on your way. We've gone to great pains to keep everyone out of that shuttle except for a selected few. All it will take is one little bomb in the hydraulics and you're one more casualty in the Venus Project. No one will be able to prove that it wasn't a lack of judgment or skill on your part that brought you to ruin."

I thought for a moment. It would not be easy piloting a truck by myself.

"I could use some help with the controls. How about Dennis Parris?"

"His grades were abysmal. He was set back and refused graduation privileges."

"There won't be any classes where we're going, and he's good in the air. Besides, we work well together. How about it?"

The old man shook his head.

"Okay. This is probably some of your street loyalty surfacing. I can't see how the experience will hurt the lad. And your confidence in his ability just might work some good on him. I'll make the arrangements."

"Thanks, pop. I won't forget it."

"Not today, anyway," Forsyth said softly to himself after I had left and the office had become quiet again. I heard about that later.

It required thirty-seven hours to complete a pre-flight work-up, plot the test schedule, and cast off fully fueled toward the planet.

She was big and gray, staring up at us on the vision screens like a bloated, blind eye. I reminded myself how much I hated her for taking Beth away. Our flight would be a challenge, a direct affront on the goddess herself.

But there was not that much time for reflection on the past. We dropped into a trailing orbit and began to descend into the cloud mantle. Beside me, Dennis watched the instruments, calling out pressures and altitudes. An ultraviolet scanner showed me the turmoil of the storms as they swept across the upper cloud deck. The safest point of entry lay on the equator. Here the wind bands were long and even, like vast rivers sweeping round and round the planet. It was important to trail the shuttle into the millrace of air. To meet the hurricane force winds head-

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on might mean losing a wing if the shuttle were whipped about violently.

Meeting Venus was something like slipping into a maelstrom.

The yellowish disk expanded until we were racing across the roof of the world. Mist began to lash against the scanner plates. Belts and walls of thin fog rose up to impede us. The shuttle smashed through them. Visibility dropped abruptly. We were blind. Technically, we were in the clouds. But the thick, poisonous soup of the main atmosphere wouldn't envelop us until we had dropped another four or five miles.

".05 atmospheres," Dennis reported evenly.

I put the nose down sharply as the air speed dropped. We had a long way to fall until reaching our test altitude.

Abruptly, we were back in the clear. It was an interface. Differing temperatures and pressures caused the cloud bands to separate into distinct layers. Spread out before the shuttle was a tableland of cloud. A single dark eddy twisted across it forming a vast canyon of shadow. It dwarfed the Earth's Grand Canyon, but within its dark walls was a zone of stillness that would allow us entry to the next cloud belt.

Once again I steepened the descent. The wings began to hum as the cloud-surface rushed up at us.

"Patch me up to the Station," I said to Dennis.

"They're ready and waiting for you, Captain."

Dennis had hesitated slightly before adding "Captain." Perhaps he was still debating whether or not he should be grateful for my insisting that he come along on this test of the Skystation model. Or perhaps he just wasn't sure of my abilities as a pilot. Well, *building confidence wasn't my job.*

"Venus Station, this is Cloudwalker One. We are entering an eddy complex. I will report our position once we reach our operational altitude. Do you read? Over."

Not surprisingly at all, Forsyth was monitoring the radio.

"Reading you Five, Cloudwalker One. Good luck."

Up to now, Irene had sat in the rear and held a tight-lipped silence. For her, that was unusual. Perhaps it was fright. Some people don't like flying but if that was her problem, she had selected an unusual profession.

"Pressure reading one atmosphere, Earth normal."

"And it's still a long way down," I muttered to no one in particular.

"What?" Dennis glanced over uneasily. He appeared younger with a flight helmet squeezed on his head.

"Just rambling. Radar clear?"

"As clear as we can expect.There's a sizable cyclonic storm building to the west, but we're leaving it behind, and we'll be far below it long before it reaches dangerous strength."

Gilbert spoke up from his seat in the rear of the cabin.

"Keep out of rough air, Teale. Our load can't take a rough ride...it might break loose in the hold."

"That's Captain Teale, joker," I snapped at him. "You just hang onto

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your seat and let me do the flying."

I saw his face get red in the mirror.

Gilbert was older than any of us, and a free engineer. Valuable cargo for the Foundation. And he knew it. He made it plain from the start that he felt I was too young, too dumb, and too irresponsible to carry out the mission. So I had punched him silly. It hadn't changed his opinion of me, or made him like me, but it did make a difference in how he followed orders after that. He still bore a blue-black bruise on one cheek. It showed like a bright tatoo even though he had powdered it before we had left the Station.

There was no return response from the stern, just silence. Fine with me.

"Two atmospheres, Captain."

Dennis sounded almost natural.

"Venus Station, this is Cloudwalker. Our altitude is fifty-two kilometers. The cloud tops are above us. We have punched into the second cloud layer. According to plan, we will level off at an altitude of fifty kilometers and launch our 'bird.'"

Forsyth came back right away.

"Don't take any chances down there. If things start to go sour, get out. Dump the model and let it go its own way. That's what the test is all about. It has to survive without your help, anyway."

"We hear you, old man. And keep your fingers crossed. We're all too young to die...even Gilbert."

The minutes were like seconds, now. We plunged into the depths of the canyon, past its misty sides, and burst through the solid bottom. The screen was a white-out, or perhaps dirty-yellow brown-out was a better description. I glanced at the altimeter without waiting for Dennis to sound off. We were almost there. I leveled the ship and let our momentum carry us deeper.

"All right, children. Unbuckle and get hopping. We've a load to drop."

Irene and Bill disappeared into the hold. Hammering noises issued through the hatch, and the soft rattling of tie-down cables being removed. This was the risky part. If things get rough, we could lose everything.

In a few minutes they were back.

Gilbert strapped down in the jump seat directly behind my couch.

"Both launchers are clear and primed."

"What do you mean both?" I studied his face in the mirror feeling like I had been had.

Irene chuckled and yawned to hide uneasiness.

"Forsyth decided that in the interests of security it might be wise to make this a double test. We could pull off a sneak launch like this once, but probably not twice. Our opponents, if indeed we have any actual opponents, are hardly dumb. The Foundation does not hire stupid people."

"Well, I'm flattered, Bill. Truly flattered."

"Convicts aren't hired. You got mailed to us."

I clucked through my teeth.

"Had to go and ruin it, and just when I was starting to like you."

"Doubt that. Anyway, we've got a

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model of VACU aboard. This one is an operational piece of hardware. If it works, we've got a powerful funding argument for the bill-payers back on Earth."

"And if it goes down the tubes, we go with it."

A long silence followed.

"Calm zone up ahead," Dennis' voice rang out. "Just what we need."

"Great," I said. "Is everyone strapped in?"

They were. It was time.

"I'm clearing the cargo area and bleeding in native atmosphere. Irene, clue me when we have a pressure match."

I used a spare scanner to take a look at the interior of the hold. It was bare and empty except for the streamlined shapes of the Skystation and VACU. I hadn't even noticed the small sphere previously. Someone had been working fast. Secretly, too. There was more to this project than I had been told.

"Pressure stable in the hold, Captain. Shall I unseal the hatch?"

This time I examined the radar myself. The screen showed calm air all around. Things couldn't have been better. Our luck was changing.

"Unseal the hatch."

"Hatch opening," Irene reported.

I felt the double topside doors pivoting upwards by the way the shuttle was handling. This would be very tricky.

Gravity had nothing to do with the launch of the models. Each would be lofted out of the hold by its own rocket assister. The assisters would drop away once the models were in free fall and operating under their own power.

"Launch on my signal, Irene."

"The doors are deployed and locked. Ready for launch."

"Toss 'em out, kid."

The shuttle shuddered as the launchers fixed and hurled their loads clear of the cargo area.

"Take over, Bill. It's your show from now on."

He was already hunched over the control board of the remotes. No answer. The low warble of a carrier wave beam could be heard coming from the earphones he wore. The modulations changed as his fingers played gently with the control bars.

I brought the airtruck around in a slow climb. Neither model could sustain rapid powered flight. They were floaters. The winds of the upper atmosphere were their motive power. So, we had to be careful not to lose them in the 'smog.' At least not until they were performing.

Minutes passed. Irene busied herself with securing the hatch doors. I was happier once they were sealed shut. With them open, the shuttle handled like a seasick whale broaching for a gasp of air. Gilbert, busy with his two toys was not in any mood for conversation, so I didn't bother him, and merely attended to my flying. I enjoyed this part of the mission. The air currents had been gentle so far. They flowed past us like a curdled river, bumpy at times, but always steady and sure. The shuttle was

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handling well, hardly straining to answer my control impulses.

Gilbert sighed abruptly. He pushed the earphones back on his head.

"The automatics have engaged. All we can do now is watch and hope they don't run into anything."

He must have meant that last part to be a joke. Venus had no mountains to speak of, and we were still so high in the atmosphere that not even a Martian peak could have touched us. But there were more than mountains to worry about on Venus. As if to punctuate that thought a long peal of thunder sounded.

Gilbert fell silent.

"Just the sibilant voice of the Goddess of Love," I told them. Shifting around in my seat, I noticed that Irene was more pale. For some obscure reason, the discovery pleased me.

"Bet you didn't know the old girl was a baritone."

She laughed, then. Her color came back to her face.

"The noise startled me. It's been so quiet up to now."

"We've just been lucky."

I looked at the radar. The air was getting 'thicker.' There was a hazy mass building to the east and moving toward us.

"How long do we have to hang around and watch over our two infants, Gilbert?"

"Venus Station is already monitoring. We're just a back-up in case there's a failure. Smyth would like us to make a mid-air snatch in case we lose one of the models. That's so we can do a de-bug in the lab. Are your flying skills up to that?"

His tone was distinctly unpleasant. It would have been a pleasure to have been able to squash his pulpy lips over his teeth. But there was a storm building and I couldn't take the time to exercise my whims.

"We'll hang in here as long as we have to. I can't say I'm too wild about playing catch. But if it's necessary, I can pull it off. Suppose you just do your job and leave mine to me."

He laughed.

"Sure, Teale. See 'ya."

He slid the earphones forward, and dropped out of the conversation.

Irene was signaling.

"There's a cold air mass building around us..."

A deafening crash of thunder drowned out the rest of her words. The very sound hurt. My ears were ringing long after the echoes had died away, rolling gradually into the distance like giant boulders rebounding down the sloping walls of a pit.

The scanners were registering lightning, jagged sheets of discharge that jumped from cloud mass to cloud mass. The darkness was alive with flickering glows of blue light.

"We should get out..."

Irene was cut off for a second time as the celestial gong rang again, and blasted us into deafness. The shuttle was jolted badly at the same moment. I saw the tip of the left wing smoking. We had been touched. Mercifully, though, the discharge had been attracted to something other than us.

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BIOLOG

by Jay Kay Klein

Bob Buckley

Just short of ten years ago, the first Bob Buckley story to be published appeared in Analog. This was the fourth written by Robert T. Buckley, Jr. It was more than two years before the second appeared, but he hasn't looked back since. This month, World in the Clouds, his first novel, begins serialization in Analog.

As a part-time writer, Bob considers himself still a beginner learning the ropes. As a full-time technical writer for the computer area of the Burroughs Corporation, he's accustomed to spending a full eight hours at a clip behind a hot typewriter.

Bob discovered science fiction and Analog nearly a quarter of a century ago, purchasing old issues back into the Forties. It was reading John Taine's well known biography of a dinosaur, Before the Dawn, in college that brought Bob into trying to write. He was born in Louisville, Kentucky, and raised in San Diego, California, where he attended San Diego State University for a B.A. degree in experimental psychology.

Higher education was interrupted for four years while he saw the world as a member of the U.S. Navy. This helped give him a long-view perspective on what we're doing with the Earth. Interested in paleontology and seeing ourselves as part of a long process leading into space, Bob is sure these next hundred years are critical to our survival and becoming part of a galactic community.

His stories reflect this belief in the dawn of the Space Age, but he still remembers Taine's primeval dinosaur. His next big writing project is a definitive study on the Terrible Lizards and what happened to them. Somehow, there seems to be a lesson to be learned here, between letting a changing world drive you under and finding new worlds in which to live.

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To dive into the growing storm would be suicide. The worst was below us. The lightning would be more fierce, and there would be rain. Acid rain. Once the protective coating of teflon sealers and ablatives was marred the acid would eat its way into the fabric of the ship. When the wings failed we would be gone, a black star falling into a cloudy void.

There was no choice, we had to ascend or die.

"Everybody better be strapped down."

The wind was toying with us, hammering at the wings in playful gusts. My arms and legs were beginning to ache even though the hydraulics were doing most of the work of moving the rudder and lifters. My fingers were stiff, too. I began to flex them, holding onto the padded wheel with my palms and thumbs.

Then we dropped almost two hundred feet in a matter of seconds. It was so sudden none of us were prepared. I bit my tongue. The warm, salty taste of blood filled my mouth. And we were still falling, weightless.

"Pull up! Pull up!" Irene was screaming over and over again.

But there was no way. The shuttle wasn't falling on its own, she was caught in a downrushing river of air.

Just as suddenly, we were thrown sideways. Again the thunder hammered at us. The port screen blew out, its CRT overdriven by the intensity of light transmitted by the camera. Perhaps the camera had gone, too. For some reason the loss of the scanner worried me more than what was happening outside.

We dropped another hundred feet, and then flipped over on our back, helpless. All control was gone. The wind was too strong to be affected by the airflows passing about the hull and wings of the shuttle. We were encapsulated in a tiny island of turbulence being carried along in a millrace.

I was no longer sure what direction we were traveling in. The altitude indicator had jammed.

An alarm began shrieking. Over and over the shrill *wheep* rang out. Red lights were winking on the panels. But I was dizzy. There was a blackness behind my eyes. I couldn't blink it away. It was like a blanket being drawn over my consciousness.

Dimly, I could hear Irene screaming over the crying of the alarm.

Gilbert was yelling something about the sun.

Thunder and lightning exploded across the bow and another screen went black. I lurched forward and pulled down on a large, plastic handle. It was green. The greenness was the same color as the leaves of a tree that had once grown in a lot outside my tenement. It was the only tree for blocks until a punk cut it down on a dare from his gang. It had been beautiful. So was the handle, but I didn't realize why at the time. I was losing consciousness. We were spinning . . . but up or down? There was no way to tell.

The blackness swallowed me.

TO BE CONTINUED

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A General Theory of Living Systems

The observation that the same patterns, even the same equations, recur in widely different physical systems has provided many shortcuts to understanding. The same process may lead to important breakthroughs in the biological and social sciences.

ROBERT A. FREITAS, Jr.

The physical sciences of humanity are fast approaching the goal of an integrated mathematical theory of the inanimate cosmos. Unfortunately our biological sciences remain a hodgepodge collection of partial theories at present, and our behavioral, social, and political sciences lag still further behind. But the recent emergence of a comprehensive "systems" framework offers the bright promise of a patterned mosaic of knowledge that explains and relates together the processes inherent in all living things. Systems scientists today are attempting to construct a general living systems theory embracing all aspects of life on Earth *from cells to societies.*

What, exactly, is a "system"?

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Webster's Unabridged defines it simply as "a set or arrangement of things so related or connected as to form a unity or organic whole." While this is certainly suggestive, scientists prefer more precise terminology, as for example: "A system is a nonrandom accumulation of matter-energy, in a region of physical space-time, which is organized into interacting interrelated subsystems or components."

Examples of systems are all around us. The car we drive to work is a mechanical system. The human body is an organism system. The United Nations is a supranational system. Livers and eyeballs are organ systems. General Motors is a corporate organizational system. A bacterium is a cellular system. The Milky Way galaxy is a gravitational system.

What is *not* a system? Any set of subsystems or physical components which do not interact, or which do not have relationships in terms of the variables under consideration, is not a concrete system. Physicists call it a "heap." Again, examples abound. My stomach and your spleen, taken together, are not a system. Neither are the cells in your hand and the cells in your leather wallet. At another level, all the coal miners in Appalachia were not a concrete system until they were organized into an interacting, intercommunicating trade union.

General systems theory consists of a set of related definitions, assumptions, and propositions dealing with reality as an integrated hierarchy of organizations of matter and energy. But general *living* systems theory is concerned solely with a special subset of all systems in the universe—the living ones. To understand what "living"means, we must first take a look at the concepts of *matter-energy* and *information.* Why? Because all living systems known to Earthly scientists are made of matter and energy organized by information.

Matter is anything that has mass and occupies space. Energy is formally defined in physics as the ability to do work. According to the principle of conservation of energy, energy can be neither created nor destroyed. However, it may be changed from one form into another form, including the energy equivalent of rest mass. Matter may have kinetic energy (the energy of motion), potential energy (stored energy), and rest mass energy, which arises from the fact that mass and energy are equivalent. Either may be converted into the other according to Einstein's famous $E = mc^2$ (rest mass energy equals mass multiplied by the speed of light squared).

All living systems need matter-energy in adequate amounts: Heat, light, water, minerals, fuels, steel, foodstuffs, and other raw materials. Energy to power the many processes of life usually comes from the breakdown of molecules (sugars, proteins, coal, gasoline), but occasionally also from the breakdown of atoms (nuclear power plants in certain modern societal systems). Apparently living systems at all levels must have subsystems or components which process

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the necessary matter-energy.

The *patterning* of matter-energy is information. The greater the complexity of any living system, the more information is required to describe it.

Information, like mass and energy, may be measured quantitatively. Communications engineers commonly define it as the logarithm to the base 2 of the number of alternate patterns, forms, organizations, or messages. (NOTE: When $m^x = y$, x is called the logarithm of y to the base m.) The fundamental unit of information is the binary digit, or "bit." One bit is that amount of information which is necessary to answer a question having two equally likely alternatives. For instance, a secretly chosen letter of the English alphabet may be guessed by asking as few as five yes/no questions. Thus we say that a single letter represents five bits of information. Correspondingly, a five-letter word represents $5x5 = 25$ bits of information, a 50,000-word book $25x50,000 = 1,250,000$ bits, and so forth.

All living systems need information in varying amounts. Information on how to reproduce is found in the genetic DNA template in all living cells. The pancreas (a human body organ system) needs data on blood sugar levels in order to produce the correct amounts of natural insulin. Individual organisms need information about the local environment (provided by eyes, ears, and other means) in order to survive. Companies require market data, R&D research, and legal advice to compete successfully; societies need town meetings, newspapers, and elections to remain healthy. Living systems at all levels must have subsystems which process information.

It is important to bear in mind that there is no principle of conservation of information analogous to the concept of matter-energy conservation. Total information can always be decreased in any physical system without increasing it elsewhere. Surprisingly enough, however, information *can* be increased by decreasing it somewhere else by a larger amount. All living systems, from cells to societies, perform this subtle magic. How can they do this?

A "closed" system has impermeable boundaries through which no matter-energy or information may pass. According to the Second Law of Thermodynamics, randomness and disorder (entropy) in any closed system must always increase. Patterned structures must degrade irrevocably over time—a log burned in a sealed container cannot be unburned. Any organized matter-energy trapped within a closed system gradually becomes disordered and tends toward a final state of maximum randomness. Information then is progressively destroyed.

"Open" systems, on the other hand, have boundaries at least partially permeable to external sources of matter-energy and information. The Second Law permits information in open systems to increase, decrease, or stay the same.

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Perhaps the most important characteristic of living systems is that they are open systems, functioning constantly to avoid the loss of information and complexity. This they do by ingesting inputs of food, fuels, or other forms of matter-energy which are higher in complexity than their outputs. That is, by consuming ordered materials and excreting less-ordered materials, living systems can absorb patterning and information from external sources and thus maintain internal complexity against the natural randomizing forces of nature.

In other words, living systems convert order in their surroundings into disorder, and thereby increase their own internal order. This is the essential process of life.

THE GENERAL THEORY

Dr. James Grier Miller, pioneer in systems science and president of the University of Louisville in Kentucky, is largely responsible for developing what is the most comprehensive and far-reaching general living systems theory devised to date. In his fascinating 1100-page monograph entitled *Living Systems* (McGraw-Hill, N.Y.; 1978), Miller assembles an incredibly diverse multidisciplinary compilation of facts, figures, researches and ideas, and blends them smoothly into a single coherent unity.

According to Dr. Miller, the universe is comprised of a natural hierarchy of systems. Each system is more complex than the last and is built up from simpler systems. For example, atoms are composed of particles; molecules are made of atoms; crystals and organelles are constructed with molecular and atomic building blocks. The subset of living systems begins just above the level of crystallizing viruses such as the tobacco mosaic variety. Since viruses are necessarily parasitic upon cells for their existence, they are not considered to be alive by most biologists.

Above the virus there are seven hierarchical levels of living systems. *Cells* (a single cell in your body, or in any animal or plant on Earth), are at the simplest level, composed of atoms, molecules, and multimolecular organelles. At the next level is the *organ* (your heart, liver, brain), made up of cells aggregated into tissues. Then there is the level of *organism* (you, your dog, a fruit fly, a tree), with organs, tissues and organelles. At the fourth level there are *groups* (herds, flocks, forests, families, teams, committees, tribes), of organisms. Next is the *organization* (cities, hospitals, corporations, universities), comprised of groups and individual organisms. Then there is the *society* or nation, made up of organizations, groups, and individuals; and finally *supranational systems* (United Nations, European Economic Community, NATO), composed of societies and organizations.

By itself, the idea of hierarchical levels is not terribly exciting. What *is* exciting is that, according to Miller's theory, *the same 19 critical subsystems may be found in every living system, at each of the seven basic*

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levels of life activity!

What are these nineteen critical subsystems? As shown in Table I, there are eight subsystems which process only matter-energy, nine subsystems which process only information, and two subsystems which process both matter-energy and information. Dr. Miller claims that every living system must perform the same nineteen basic functions to stay alive. If any one subsystem is blocked or destroyed, the system eventually dies.

At the top of Table 1 are the two critical subsystems that process matter-energy and information simultaneously. The first of these is the *reproducer,* capable of giving rise to other systems similar to the one it is in. This is a unique function, since it is critical only to the survival of the class of system or species involved and not to the system or individual itself. (Living systems often continue to exist even though they cannot reproduce—worker bees, mules, and so forth.) Reproduction, involving the transmission of a genetic template, blueprint, or charter to succeeding generations, seems mainly to be an information transmission process. Yet the matter-energy necessary to physically construct the next generation must also be processed by the

TABLE 1

SUBSYSTEMS WHICH PROCESS BOTH MATTER-ENERGY AND INFORMATION

Reproducer
Boundary

SUBSYSTEMS WHICH PROCESS MATTER-ENERGY	SUBSYSTEMS WHICH PROCESS INFORMATION
Ingestor	Input Transducer
—	Internal Transducer
Distributor	Channel and Net
Convertor	Decoder
Producer	Associator
Matter-Energy Storage	Memory
—	Decider
—	Encoder
Extruder	Output Transducer
Motor	—
Supporter	

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reproducer.

The *boundary,* like the reproducer, serves a dual function. This subsystem, located at the system perimeter, controls the flow of matter-energy and information into and out of the system. It also holds together the other components that comprise the system and protects them from environmental stresses and traumas.

Farther down in Table 1 are two parallel columns, identifying those critical subsystems which process either matter-energy or information, but not both. Entries appearing opposite one another perform functions with important similarities. (For instance, the "distributor" does for matter-energy approximately what the "channel and net" does for information.)

The first matter-energy processing subsystem is the *ingestor,* responsible for bringing raw materials and energy from the environment across the system boundary.

Next, the *distributor* carries inputs from outside or outputs from internal subsystems around the system to each component.

The *convertor* changes certain inputs to the system into forms more useful for the special processes within that particular system.

The *producer,* using matter-energy inputs to the system directly or outputs from the convertor, builds up stable aggregations of matter capable of enduring for long periods of time. These synthesized materials are used for growth, damage repair, replacement of worn or obsolete components, production of the system's output of products, providing energy for physical motion, or for creating information "markers" for use in communication with the external environment. (Information, so far as we know, is always borne on a marker of matter-energy.)

The subsystem called *matter-energy storage* serves a warehousing function, retaining in the system for different periods of time deposits of various sorts of matter-energy.

The *extruder* transmits matter-energy out of the system in the form of finished products or wastes.

The *motor* subsystem moves the system or its parts relative to all or part of the external environment, or moves components of the environment itself in relation to each other.

Finally, the *supporter* maintains the proper spatial relationships among system components, allowing each to interact without interfering with or seriously crowding the others.

Like the matter-energy metabolism of all living systems, an information metabolism exists as well, consisting of nine principal components. By analogy to the sequence of matter-energy subsystems discussed above, information metabolism includes inputs, internal processes, and outputs of various information signals.

The first information processing component is the *input transducer,* a sensory subsystem that brings information-laden markers into the system and changes them into other matter-

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energy forms more suitable for internal transmission.

The *internal transducer* serves a related function with regard to information markers originating within the system. It is a sensory subsystem that receives information from internal components of the system relating to significant changes in the status or condition of those components. The internal transducer then changes this data into other matter-energy forms capable of easy transmission throughout the corpus of the system.

Channel and net is the subsystem comprising a route or routes in physical space by which markers bearing information are transmitted to all parts of the system.

The *decoder* accepts data from either the input transducer or the internal transducer in a "public" code and converts the information into a "private" code more easily understood by other internal components.

The *associator* carries out the first stage of the learning process, by forming enduring associations among items of information within the system.

The *memory* carries out the second stage of the learning process. Various sorts of information are stored in the system for different periods of time. Data generally remain in memory and can be retrieved upon demand, until replaced by new data or until misplaced, garbled or destroyed by the normal disordering and randomizing processes that occur in all physical systems over time.

The *decider* is the executive subsystem which receives information inputs from all other subsystems and transmits to them information outputs that control the entire system. The decider is the "boss." It makes choices among alternatives; that is, its input always contains more alternatives or patterns or "degrees of freedom" than its output. The decider is the only absolutely essential subsystem, because a system cannot be parasitic upon or symbiotic with another system for its deciding.

The *encoder* alters the "private" code of internal transmissions back into a "public" code that can be interpreted by other systems in the environment. Encoders and decoders thus serve reciprocal functions, although they operate on different data.

Finally there is the *output transducer,* the subsystem that changes information markers within the system into other matter-energy forms which can be transmitted over external channels in the environment, and then emits these markers from the system.

Table 2, provided by Miller, is of great value in visualizing how the 19 critical subsystems relate to reality. In the table there are 19 rows, representing each important subsystem, and seven columns, for each of the hierarchical levels of living systems. The progress of modern science is such that all but seven of the 133 spaces in Table 2 can be filled in with concrete, physical examples. In those seven special cases, however, there is evidence that the processes in question *are* being carried out somehow. These gaps,

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TABLE 2

Selected Major Components of Each of the 19 Critical Subsystems at Each of the Seven Levels of Living Systems

	LEVEL						
SUBSYSTEM	Cell	Organ	Organism	Group	Organization	Society	Supranational System
Reproducer 3.1.1	Chromosome	*None;* downwardly dispersed to cell level	Genitalia	Mating dyad	Group that produces a charter for an organization	Constitutional convention	Supranational system which creates another supranational system
Boundary 3.1.2	Cell membrane	Capsule of viscus	Skin	Sergeant at arms	Guard of an organization's property	Organization of border guards	Supranational organization of border guards
Ingestor 3.2.1	Gap in cell membrane	Input artery of organ	Mouth	Refreshment chairman	Receiving department	Import company	Supranational system officials who operate *international ports*
Distributor 3.2.2	Endoplasmic *reticulum*	Blood vessels *of organ*	Vascular system	Mother who passes *out food to family*	Driver	Transportation company	United Nations Childrens Fund (UNICEF), which distributes food to needy children

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Converter 3.2.3	Enzyme in mitochondrion	Parenchymal cell	Upper gastrointestinal tract	Butcher	Factory production unit	Trucking	Supranational organization which [illegible]
Producer 3.2.4	Enzyme in mitochondrion	Parenchymal cell	Unknown	Cook	Factory production unit	Trucking	Supranational organization which [illegible]
Matter-energy storage 3.2.5	Adenosine triphosphate (ATP)	Intercellular fluid	Fatty tissues	Family member who stores food	Stock-room operating group	Warehouse company	International fleet ships which [illegible]
Extruder 3.2.6	Gap in cell membrane	Output vein of organ	Urethra	Cleaning woman	Delivery department	Export company	Component of the International Atomic Energy Agency (IAEA) concerned with waste extrusion
Motor 3.2.7	Microtubule	Muscle tissue of organ	Muscle of legs	*None:* laterally dispersed to all members of group who move jointly	Crew of machine that moves organization personnel	Trucking company	Transport component of the North Atlantic Treaty Organization (NATO)
Supporter 3.2.8	Microtubule	Stroma	Skeleton	Person who physically supports others in group	Group that operates organization's building	National officials who operate public buildings and land	Supranational officials who operate United Nations buildings and land

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Miller says, "constitute challenges for further basic research."

CROSS-LEVEL HYPOTHESES

General living systems theory is an evolutionary theory. The general direction of evolution has been to produce systems with greater complexity of organization, packed with more and more information. Miller explains this by using what he calls the evolutionary principle of "shred-out," a sort of systemic division of labor. In this division, each process is broken down into multiple subprocesses, redistributed over multiple physical structures, each of which becomes specialized for carrying out a particular subprocess. It is, as Dr. Miller suggests, "as if each strand of a many-stranded rope had unraveled progressively into more and more pieces."

Consider a population of primordial living cells, each having all 19 critical subsystems. As mutations occurred in the original cells, the mutant entities continued to live only if they were still able to perform all nineteen critical processes. Those mutants that could not were ruthlessly eliminated by natural selection; those that could survived to reproduce more of their own kind.

As more complex cells evolved, more complicated subsystems emerged—but always the same basic 19 processes had to be performed. As cells gave rise to higher systems at more advanced levels—organs, organisms, and so forth—their subsystems "shredded out" into increasingly sophisticated units carrying out more complex and often more effective versions of the nineteen processes. Each of the critical subsystems was essential for the survival of every living system at every point in this evolution. If any one of these subsystems had ceased to function even briefly, the system it was in soon would have ceased to exist. So evolution didn't eliminate any of the subsystems, and each of the nineteen are found today at every level from cell to supranational system. This basic principle of evolutionary unity makes it possible to derive valid cross-level generalizations in the study of living systems.

Systems scientists normally concern themselves with confirming or disproving a hypothesis relevant to a single critical subsystem or to some other specific aspect of a single system. Tests are conducted on only one type of system at one level. But in the "general systems" paradigm, the proposition will next be tested on other types of systems at the same level, and later on systems at different levels, using the same variables and dimensional units of measurement. Some hypotheses may be found valid at all levels of living systems; others may apply only to a few levels.

Dr. Miller lists nearly two hundred cross-level hypotheses of possibly general validity. Most of them have been discovered on one particular hierarchical level, and have then been tentatively extended and at least cursorily checked at two or more different levels. I cannot possibly list and discuss all of Miller's propositions

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here, but a few of my favorites include the following:

Hypothesis 3.3-1: *Up to a maximum higher than yet obtained in any living system but less than one-hundred percent, the larger the percentage of all matter-energy input that it consumes in information processing controlling its various system processes, as opposed to matter-energy processing, the more likely the system is to survive.* In other words, a system cannot be "too smart." It is probably true that more complex species devote a larger fraction of their total cell mass to information processing than lower species, and no one has yet discovered a species that failed to survive because too much of its body was neural tissue. Modern organizations and advanced societies are committing continually higher percentages of their available matter-energy to the communications media and other forms of information processing, vastly more than "primitive" societies do.

Hypothesis 3.3.7.2-14: *A system which survives generally decides to employ the least costly adjustment to a threat or a strain produced by a stress first and increasingly more costly ones later.* This is a restatement of the principle of least effort. Amoebas, for example, will eat nearby food first before swimming to engulf more distant morsels. Artificially-increased acidity in a dog's bloodstream will be compensated first by hyperventilation or "overbreathing" (an attempt to produce alkalosis), and if this does not work, then by increasing the rate of chloride excretion into the urine (a more complicated adjustment). When goals are frustrated, people resort first to goal-shifting, then to rationalization, then repression, and finally psychosis if all else fails. An army, in order to repel an attack, may sacrifice first a squad, then companies of regiments, and finally, if still unsuccessfull, entire divisions may be thrown into battle.

Hypothesis 3.3.7.2-18: *Systems which survive make decisions enabling them to perform at an optimum efficiency for maximum physical power output, which is always less than maximum efficiency.* In other words, surviving systems are designed for peak loads, not normal loads. The most efficient system survives only if it can also put out maximum physical power when needed, especially in combat or competitive situations. The "fight-or-flight" response of many animals diverts blood from the gut to the extremities, enhancing fighting energy and providing faster clotting to seal wounds. The cooks in an army under attack are allowed to leave their camp stoves and pick up rifles to participate in a maximum defensive effort to preserve the organization. In wartime, a society may conscript soldiers, increase taxes, commandeer vehicles and living quarters, and divert industry to the production of specialized war material.

Hypothesis 5.2-8: *A system usually associates with other systems which have arisen from similar templates rather than with those derived from*

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dissimilar templates. That is, "birds of a feather flock together." There are many examples at all levels of living systems. When different types of embryonic cells are mixed together randomly, they sort themselves out and grow together only with other cells of the same type. Organ transplants tend to be rejected by the receiving organism. Family members often keep nonmembers out of personal relationships. Ethnics arriving in the United States for the first time tend to live near others of the same ethnic group. Companies doing business in similar fields meet in conventions among themselves more often than they meet with other types of companies. Nations of comparable origin and heritage tend to vote together in the United Nations.

Hypothesis 5.2-13: *Under threat or stress, a system that survives, in the common good of total system survival, temporarily subordinates conflicts among subsystems or components until the threat or stress is relieved, when internal conflicts recur.* In other words, external threats unite warring factions. If a man and wife are having an argument and a well-meaning neighbor tries to intervene, the pair will temporarily suspend their differences and join in the ejection of the interloper. Public opinion is less likely to support an employee strike in organizations that provide essential services (hospitals, police, fire departments) than in organizations providing less-essential services. During wartime or periods of national disaster, societal, economic and social differences are often submerged in an attempt to meet the common threat—or the society may not survive. Supranational systems may close ranks in the face of a perceived threat to global stability, as for example the United Nations peacekeeping forces stationed in and around the Middle East and elsewhere.

APPLICATIONS

At this point, the reader may be wondering: "Fine, but can the dog hunt?" To be useful, any theory must generate concrete results. While full experimental investigation of his hypotheses remains a task for the future, Dr. Miller believes that living systems theory is more than a mere collection of truisms. The tremendous power of the theory derives from its broad and general applicability, which manifests itself in two distinct ways.

First, the theory permits different systems within the same level to be compared directly and quantitatively. Examples might include comparisons of organismic memory subsystem function in unrelated animal species to uncover new principles of neurological evolution, or of the informational bit rates through the channel and net subsystems of democratic, oligarchic, and totalitarian societies to discover broad new principles of efficient operation applicable to any governmental organization. To the detriment of science such relationships rarely have been paid much serious attention by mainline scientists. By encouraging generalizations

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within a given hierarchical level, general living systems theory demands an ecological and holistic worldview of its practitioners. One early and controversial result of this kind of approach was the World III Model devised by the Club of Rome group at MIT. The purpose was to try to predict overall limits to growth of human society on Earth. Though admittedly a gross oversimplification of reality, the Model attempts to take account of the many different interactions among global system components—including population, capital, food, nonrenewable resources, and pollution.

Second, Miller's living systems theory is "general" inasmuch as it adopts a predominantly cross-level approach. This is immediately useful in a number of ways. In addition to the unification of diverse scientific and technical disciplines, the theory can help to identify unstudied variables and to illuminate gaps in existing knowledge. We recall the holes in Mendeleyev's Periodic Table of the Chemical Elements (first drawn in 1869) which predicted the discovery of the then-unknown elements germanium, gallium, scandium, etc. Similarly, the boxes in Table 2 marked "unknown" suggest gaps in current biological knowledge that may be remedied by further research.

Equally important, the theory promotes cross-level intellectual fertilization Generalizations established at one level may be transplanted to others. Discoveries at the level of the cell or organ may foreshadow comparable results in studies of organizations or societies. It is virtually certain that the pace of scientific progress would quicken if the general systems approach were more widely adopted.

Many times in the past, qualitatively similar phenomena have been rediscovered at several different levels but the traditional rigid insularity of the academic disciplines forestalled any possibility of idea-transfer between levels. For example, B. F. Skinner's work on operant conditioning was done on whole organisms—humans, pigeons, rats and the like. Skinner then suggested, in his novel *Walden II,* that this mode of learning might be extended to societies as well. And, in the last decade, biofeedback researchers have discovered that the "behavior" of internal organs likewise may be "conditioned." The astute general living systems theorist immediately will pause to consider whether Skinner's basic idea also might be applicable at the levels of the cell, the group, the organization, and the supranational system. Why wait for workers at each level independently to rediscover the same process?

The general systems approach also permits quantitative analysis. The same variables may be used to describe systems at different levels. For instance, a researcher may wish to evaluate a hypothesis concerning the matter-energy storage subsystem at all levels of human living systems, say, in Italy. A relevant system variable is rate of energy usage, which the researcher may determine as follows:

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human neuron (cell), 3 x 10^{-9} watts; human brain (organ), 30 watts; human body (organism), 150 watts; Italian steel factory (organization), 10^{7} watts; the nation of Italy (society), 3 x 10^{7} watts; and NATO (supranational system), 3 x 10^{12} watts.

Dr. Miller himself has experimentally examined several cross-level hypotheses suggested by the general theory of living systems. His personal interest lies in the processes of the channel and net subsystem and the problems of information overload and underload in living systems. Drawing on his earlier investigations of individual neuron response to data input overloads, and applying the systems approach, Miller formulated the following two cross-level hypotheses:

Hypothesis 5.1-1: *As the information input to a single channel of a living system—measured in bits per second—increases, the information output—measured similarly—increases almost identically at first but gradually falls behind as it approaches a certain output rate, the channel capacity, which cannot be exceeded in the channel. The output then levels off at that rate, and finally, as the information input rate continues to go up, the output decreases gradually toward zero as breakdown or the confusional state occurs under overload;* and

Hypothesis 5.1-25: *Channels in living systems at higher levels in general have lower capacities than those in living systems at lower levels.*

Miller set out to verify or disprove his hypotheses. First he checked the published literature at each level and found surprisingly strong support. Encouraged, he returned to the laboratory and set up a number of experiments designed to test the two hypotheses at the five levels of cell, organ, organism, group and organization. (It's hard to perform controlled tests on whole societies and supranational systems.) At each level, the response of the channel and net subsystem to a variety of information input rates was measured and recorded. The median maximum transmission rates per channel were found to be as follows: 4000 bits/sec for the cell, 55 bits/sec for the organ, 4.75-5.75 bits/sec for the organism, 3.44-4.60 bits/sec for the group, and 2.89-4.55 bits/sec for the organization.

These results support the hypotheses. By extending his knowledge of nerve cell behavior to other levels, Miller has discovered what may well be a general property of *all* living systems: When information input rate goes up, output rate increases to a maximum and then decreases, showing signs of overload. Apparently cells, organs, organisms, groups and organizations each react to data overloads in much the same way, with lower maximum bit rates at higher levels of living systems. Organizations as a whole can process more information than groups or individuals because they can use multiple channels.

The general theory should be widely applicable to many areas of human endeavor and to the solution of in-

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numerable specific human problems. Cross-level hypotheses and multilevel concepts will permit advances in such diverse fields as pharmacology, human and veterinary medicine, applied botany and agriculture, biochemistry, biophysics and bionics, psychiatry, applied psychology, group psychotherapy and group dynamics.

At the level of the organization applications may include operations research on governmental agencies, transportation and communication services, corporate and factory efficiency, agronomics, education and health and justice delivery systems, and library and other information retrieval systems. At the national level, living systems theory can organize thinking and suggest solutions to problems in population control and family planning, energy crises, pollution control, resource allocation, industrial systems and economic cycles, and in military and environmental planning. The work on supranational systems, drawing lessons from lower hierarchical levels, can begin to address key questions in international law, integration of global services (World Health Organization, Universal Postal Union, UNESCO, and so forth), world economic planning, international relations and political stability, and the conduct or avoidance of global war.

There are also a number of highly speculative applications of Miller's theory. For instance, computer scientists should find it much easier to design and construct a thinking machine, working backwards from a theory of living systems. Research into the fundamental subsystems of the human brain will provide a model upon which artificial intelligence specialists may someday build an electronic intellect to act in the capacity of the "decider" subsystem in a fully-integrated and sophisticated mechanical android body.

Another possibility is the prospect of a science of psychohistory as envisioned by Isaac Asimov in his *Foundation Trilogy* classic. When a mature systems science unites biology, ethology, psychology, sociology, organizational dynamics and political science, then prediction of the future course of human civilization may become a reality. It may also be feasible to redesign entire organizational and societal systems to comply with precise specifications of stability, efficiency, longevity, growth, or even specific moral, ethical, or religious standards.

Miller's theory may also be relevant to our search for alien civilizations located elsewhere in the universe. There could exist at least three higher levels of sentient organization beyond Miller's nominal seven: Interplanetary society, interstellar community, and galactic civilization. If the general theory of living systems is directly applicable at these higher levels too, it may be possible to make some reasonable guesses as to the sociological, cultural, and governmental forms that might be chosen by highly advanced extraterrestrials to organize their far-flung interstellar empires. ■

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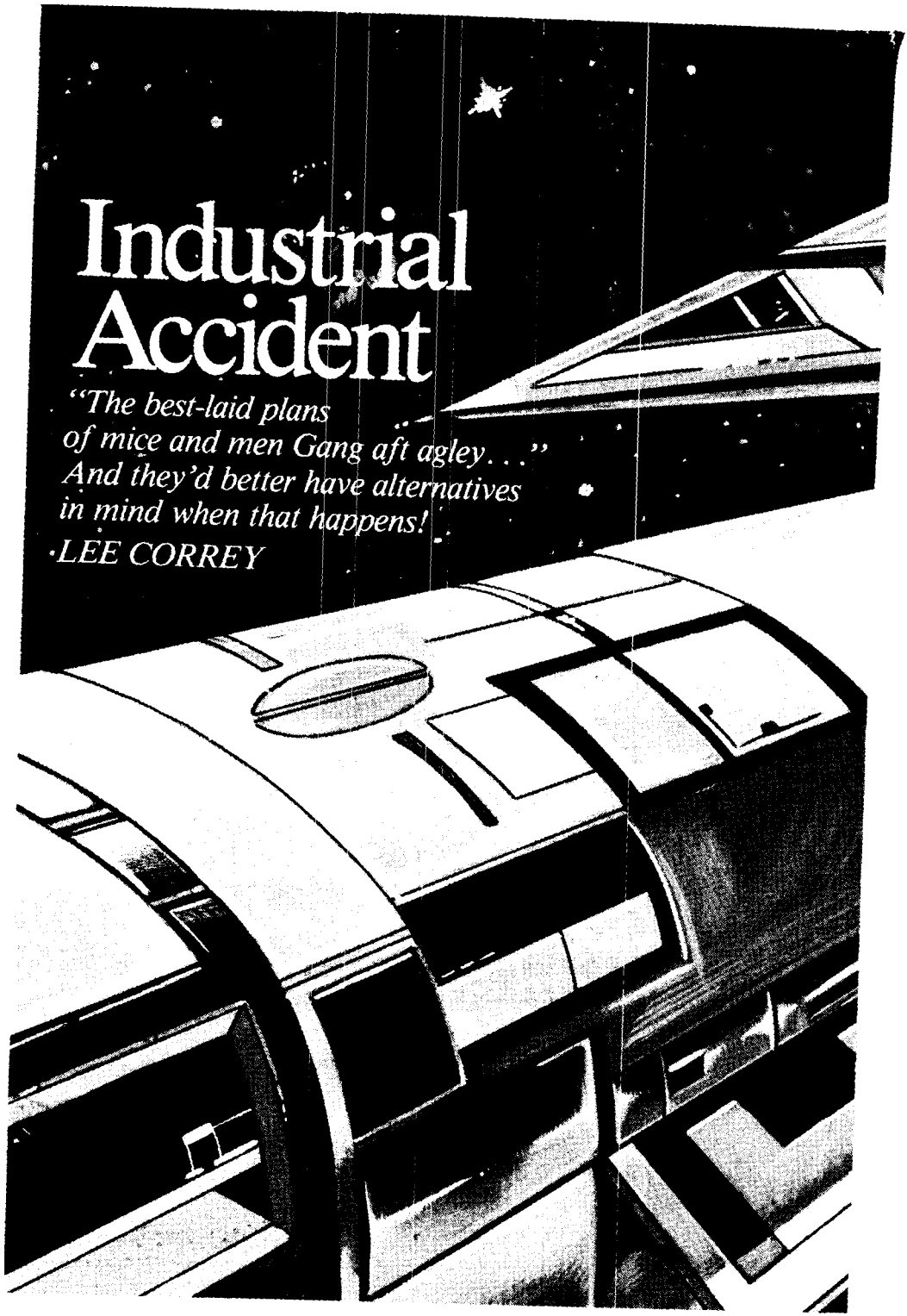
Industrial Accident
"The best-laid plans
of mice and men Gang aft agley..."
And they'd better have alternatives
in mind when that happens!
LEE CORREY

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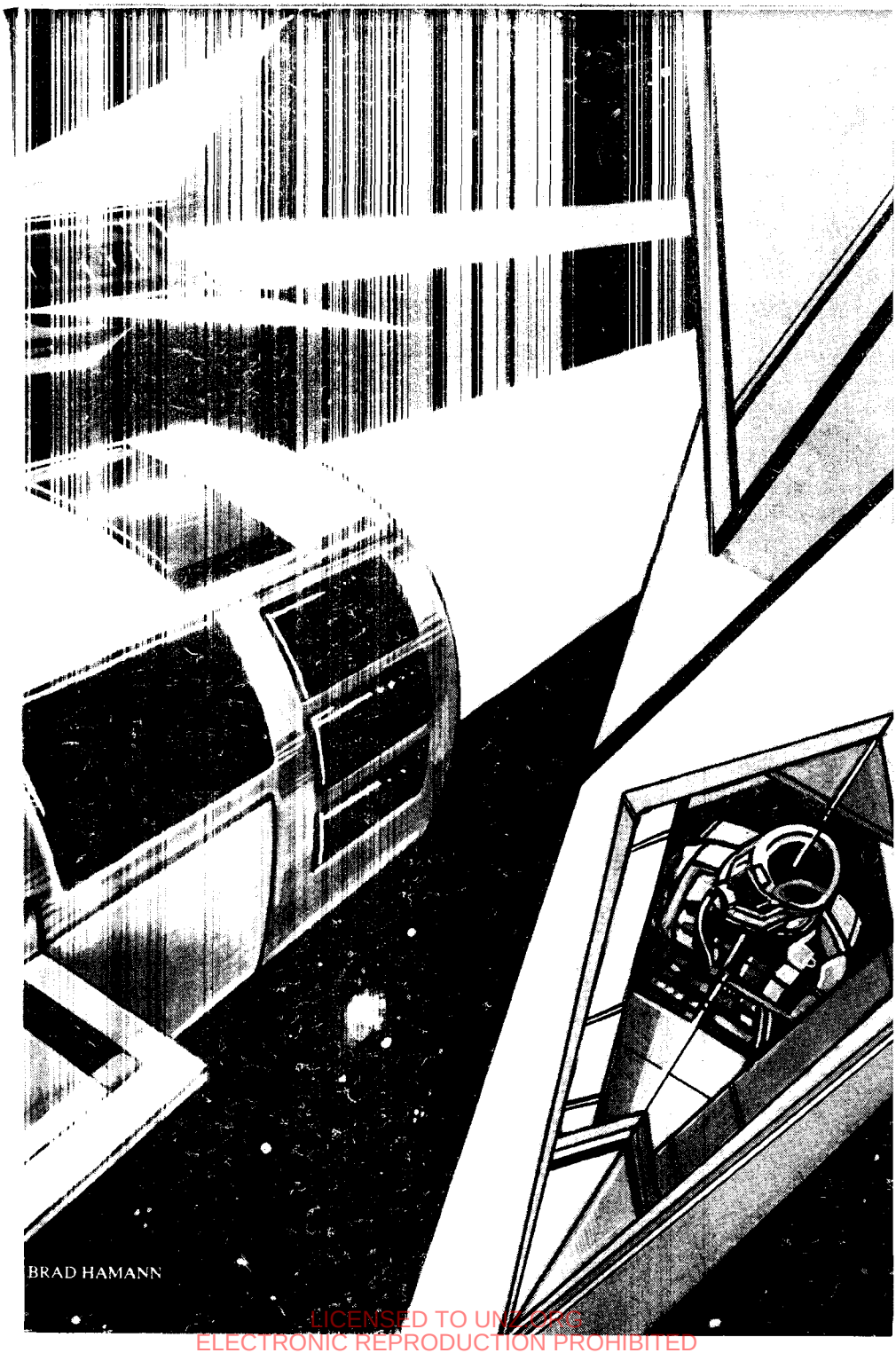

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It was inevitable that it would happen someday.

And it did happen...and nobody will ever know why.

Perhaps an electron did not move from one crystal lattice to another because of a solar X-ray photon or a high-energy cosmic ray, in spite of shielding. Regardless of cause, the effect was known. The book-sized package of nucleide electronics of the autopilot and guidance system did not send the command signal to the fusion-powered pulsed plasma space drive. As a result, the space drive did not swivel, causing TriPlanet Transport's Load SLZ-420 to perform the required end-over-end skew flip to begin deceleration for eventual Earth-orbit insertion. Instead, the glitch locked out the command receiver.

SLZ-420 had boosted away from the planetoid Pallas at a constant acceleration of one-tenth standard gravity. This doesn't sound like much acceleration. But, at the programmed turn-over point, the SLZ-420 was moving at a sun-referenced velocity of more than 600 kilometers per second.

Now, instead of starting to slow down on its journey to the space factories in orbit around the Earth, SLZ-420 kept on accelerating.

For centuries, people had been afraid of things falling on them from the sky—early aeroplanes, meteors, comets, and even small planetoids. The doomsday literature of the early Space Age was full of such scenarios because geological evidence pointed to the fact that large celestial bodies had collided with the Earth in the distant past. And there was abundant visible evidence of such celestial bombardment on the moon, Mercury, and Mars. Scientists and engineers poohpoohed these fears as they learned that the solar system had swept itself clean of the debris of its birth.

Man-made meteors were rarely considered as one of the hazards of the Third Industrial Revolution.

SLZ-420 had become such a man-made meteor. It was nothing more than a solid cylinder of planetoid iron fifteen meters in diameter and twenty-three meters long weighing a mere 35,000 tons...a grain of celestial sand on the beach of the solar system.

The glitch in the electronic guidance system had not affected the instructions to "go to Earth" that had been implanted in its memory on Pallas. Faithfully, it continued to do its job...except for that one little program step. Faithfully, the reliable constant-boost space drive continued to work, adding one meter per second to the velocity every second...in the wrong direction. Toward Earth. Toward eight billion people aboard a giant space ship living in an ecology that was vulnerable to the man-made meteor. Toward people who were ignorant of SLZ-420 and who did not understand the consequences of what could and would happen. But, also, toward people who had not ignored the possibility that it would indeed happen some day.

The House Committee hearing room

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had not changed in nearly a hundred years. Established behind his elevated desk with the status symbols of the microphones before him sat a man who was almost indistinguishable from most of his predecessors. Representative Claypool Evans Perrin had served the people of his district for nearly a quarter of a century...or so they believed. However, he knew full well that politics was simply the interaction of various power groups. . .and thus he had remained in office through twelve election battles. He scorned implant lenses, preferring old rimless eye glasses. He felt that they lent a distinct touch to his craggy face topped by its famous unruly shock of hair, hair that was now pure white and worn long in the romantic fashion of the ancient Seventies. Perrin believed it helped maintain his image as a young-thinking firebrand radical, the image that had served him well for all those years and all those elections.

He peered now through those spectacles and fixed his stare on the man behind the witness table below him. "Please let me get this absolutely clear in my mind, Mister Armitage," he spoke in the measured cadence of his rasping voice. "The Control and Inspection Division of the Department of Space Commerce is requesting a budget line item of 4.7 billion dollars for something you term an 'emergency accident system.' If I understand this correctly, it's for the development and deployment of interceptor-type space vehicles based at L-5."

Chuck Armitage was quick to attempt a reply. "Yes, sir, we..."

But Perrin wasn't about to let the witness speak yet. "Under the terms of various UN treaties, some of them more than fifty years old, no nation is permitted to maintain any sort of deep space military system beyond that necessary to police its own space operations...sort of the equivalent of the old Coast Guard, if you will. We've spent billions of dollars to insure that the Space Watch can defend our national airspace up to a hundred kilometers, as we are permitted to do under international agreement." He paused and shook his long white hair out of his face. "Mister Armitage, isn't the Department of Space Commerce asking Congress to let you build an armed force based in space and capable of carrying out offensive military acts against space facilities as well as against Earth?"

It was a loaded question, and Chuck Armitage knew it. Hunching forward over the witness table, he looked intently back at Congressman Perrin while he collected his thoughts and tried to choose his words very carefully. His thinking processes were quite rapid in this environment because he had fought his way through many congressional appropriations hearings in the past.

"Mister Chairman, the Department can't do what you are claiming, as Secretary Seton has said many times. The intent of the budget line item request is quite different, and this is why Secretary Seton has asked me to speak for it in her stead. As head of the Con-

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trol and Inspection Division, I am the policeman of our space commerce activities and. . ."

"I have read your vitae, sir," Perrin broke in, apparently with impatience. It was, however, a technique that he used very effectively with witnesses. But it didn't work with Chuck Armitage.

"Then you know what sort of situation I am faced with on a daily basis," Armitage broke in himself. "In fact, for the past twenty-two years we have lived with the situation since the Whitney Drive was first used for constant-boost space flight..."

"Ah, yes, but for those twenty-two years, there have been no problems that space crews have not been able to solve."

"Those were manned vehicles, Congressman," Armitage pointed out. The exchange was becoming rapid-fire as both men tried to gain and maintain control of the situation.

"What possible difference does that make?"

"Problems could be solved in transit. But things have changed. The majority of cargo vehicles today are unmanned because of various governmental restrictions—not in our Department, by the way—that prevent the necessary capital accumulation required to finance manned ships."

"Well, such rules pertaining to the regulation of space commerce are not the province of this Committee!"

"No, sir, but the unmanned cargo ship is a consequence that we must deal with here. The solar system is full of unmanned ships right this instant, some of them boosting at more than a standard gee. I am responsible for the safe operation of those ships of United States' registry. And I am especially worried about the unmanned, automated vehicles. There is a finite chance that something could go wrong with an unmanned ship. . .and we would be faced with the prospect of a very large mass coming at us with terminal velocity approaching a thousand kilometers per second. . . .In effect, man-made meteors."

Perrin waved his hand. "That seems to be a rather remote possibility. Meteors have been hitting the Earth for millions of years. The government of the United States has never had to concern itself with any problems of protecting its citizens against falling meteors!" A titter of laughter ran around the hearing room. Perrin felt that he had counted coup on that one.

"We are not talking about natural meteors, Mister Chairman! Most of the natural meteoritic material out there is no bigger than a pebble...or somebody would be mining it right now! We are concerned with a recent man-made phenomenon: unmanned constant-boost cargo ships. There are more than a hundred of them boosting toward the Earth-moon system right now. We need only one failure—*one failure*—to have a worldwide catastrophe on our hands."

"Come, come! I have never known you to exaggerate in your testimony before, Mister Armitage. Worldwide catastrophe? Really!"

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"I wish it were not possible, Congressman. We estimate that the impact of a 30,000-ton planetoid ore carrier at 500 kilometers per second would produce an effect equivalent to several hundred megatons of TNT. But the scaling laws break down because we cannot extrapolate from the results of early thermonuclear warhead testing. The United States set off a ten-megaton thermonuclear device in 1952, and the Soviets blew off a fifty-megaton nuke shortly thereafter. We are not sure that . . ."

Perrin cut in again. "We're not discussing military warheads, Mister Armitage!"

"No sir, but we are discussing the rapid release of large amounts of energy—and the only difference between a large nuke and a fast-moving rock is the lack of radiation from the rock impact. In addition, when a large unmanned ship hits, it will be moving many times faster than a natural meteor, and its kinetic energy increases as the square of . . ."

"Mister Armitage, isn't your Division responsible for seeing to it that a runaway space ship could never occur? Aren't we discussing something so highly hypothetical as to be ridiculous? Aren't your people on top of the safety aspect?"

"Yes, sir, they are. Our specifications and technical directives must be followed by all manufacturers and users of equipment licensed or registered by the United States. By international agreements, all other spacefaring nations either adopt our rules or have rules that are compatible. Our field representatives inspect and sign-off all new equipment as it comes out of the factory door. They do the same for all routine maintenance, overhauls, and even for pre-boost checks."

"Then what is it that could possibly go wrong, Mister Armitage?"

"Mister Chairman, no technology is ever perfect. We are not gods; we are people with a very incomplete understanding of the way the universe works. Sooner or later, no matter how diligent we are and no matter how exhaustive our tests, something will misbehave. Let me state categorically—and I'll back it up with numbers at a later time if you wish—that there is a statistically valid possibility that the Earth will be impacted by an unmanned multithousand-ton cargo ship within the next ten years. We *must* have an emergency system of long-range deep space interceptors . . . a dozen is all that we are asking for. They would be based at our L-5 facility. They have to be because of the negligible gravity well there and because of the fact that it is easier to intercept a runaway ship as far out as possible . . .and not even very easy under those conditions."

Perrin leaned back and made a steeple of his fingertips.

"Isn't the Space Watch prepared to take care of such matters?"

"Ask the Space Watch."

"But I am asking you, Mister Armitage."

"The Space Watch interceptor force is Earth-based by treaty. The beam weapons at L-5 have limited

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power under the SWAP agreements with the Soviet Union whose L-4 beam weapons are also limited. Ask the Space Watch, sir, because they are well equipped to handle defense against Earth-launched missiles or against anything the Soviets might try to do from L-4."

"You haven't answered my question, have you?"

"I cannot answer it in open session, nor am I privileged to know all of the sensitive details of the Space Watch systems." Chuck Armitage *did* know these details. He wasn't supposed to. He wasn't cleared for that information, but he had his channels of information that were zealously protected. He had known for five years that the Space Watch did not have the capability to even deflect the course of an unmanned runaway. "This is why I suggested, Mister Chairman, that you might ask the Space Watch to. . ."

An aide leaned over Perrin's shoulder and whispered something into the congressman's right ear. Perrin nodded and glanced at his old-fashioned digital wrist watch. He turned his attention again to Armitage. "We have an important roll-call vote coming up in a few minutes. So we'll not have time to discuss this further today. We may have a duplication of effort conflict arising between Dee-Ess-Cee and the Space Watch. The fine line of division between military and civilian utilization of space has been a major problem for nearly sixty years, and I doubt that we will find the solution to it today." Perrin decided that he would mention the matter to the presidents of TriPlanet Spaceways and TransWorld Transit at dinner that evening to find out if there was any support for this program from the space transportation lobby.

The session adjourned for the day. Armitage inwardly chewed his fingernails as he gathered up his papers and stalked out of the hearing room with his deputy, George Bonnieul.

"Wait until some non-sked Zaire registry load slams into his constituency!" Chuck growled so that only George could hear.

"No reason to be upset, Chuck," Bonnieul remarked smoothly. "Perrin was Perrin today, as usual but more so. He's up for re-election and he's got some hot young competition. He wants political advantage out of this." He looked over at Armitage.

"Too damned many things in space operations have been determined by political compromise rather than by technical or economic realities," Armitage continued to mutter. "I once thought that when private enterprise became involved, it would be the end of the political football game . . . but they just started playing again with new rules . . ."

"So what else is new?" George wanted to know. "Let's say to hell with it. You-know-who called from Singapore this morning. Says the offer is still open for all of us."

"And turn the Division over to The Slob?" Chuck was referring to the civil service hack who would most probably be promoted into Chuck's

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position from a nonoperating division of the Department because there just wasn't anybody to take it if Chuck and his colleagues left. If the deal had just been for Chuck alone, he might have gotten more consideration because George would have then been in line for Division Chief.

"You have a disturbing habit of bringing up unsavory matters," George told him as they descended the long stairway to reach the elevators going to the roof. Only in a government building would one have to walk down stairs to get an elevator going up. The two men were quiet in the elevator because there were others present, although they were the only ones going all the way to the roof.

An agency aircar was waiting for them, manned and running.

Chuck sensed that something was wrong. "Didn't you park that heap in the transient area over there?"

George nodded.

The two of them walked normally over to the waiting aircar. If there was something wrong somewhere, this was not the place to indicate it by unusual action because there were, as always, news media crews standing by on the roof to interview important witnesses and newsworthy congressmen.

Immediately the door was closed, the driver put the air to the Coanda wings and went straight up to transition altitude. Only then did Chuck remark, "Howdy, Jed. How did you get here?"

The wiry little pilot, another of Armitage's assistants, replied without turning his head. "Pete brought me over and dropped me off. We didn't dare call you out of the hearing, and we wanted to make sure that you got back to the Center as quickly as possible once it was over." He paused, listened to the radio loudspeaker, replied into a microphone, then continued his monologue. "Thirty minutes ago, we got the data that Cargo Load SLZ-420 out of Pallas at one-tenth gee missed turnover a little over three hours ago."

There was not a trace of emotion on the faces or in the actions of either man, but this belied the inner feelings that each of them had at the moment. But they were professionals in a high tech area and were trained not to display their emotions. George took out his pocket computer, pulled out the antenna, and put it near the south window of the aircar so that it could communicate with the geosynchronous data transfer satellite that was linked to the computers at the Center and with the internationally-maintained master unit at Singapore. "A little more than sixty-six hours to arrival here," George announced.

"Any telemetry indication of the malfunction?" Chuck then asked the driver.

"I've told you all I know. I left Center just after the alert sounded," Jed remarked. "Please let me handle this rush-hour traffic so that I can get you to Center as quickly as possible without arousing interest."

"The sheer coincidence of this amazes me," George said in deliberate

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understatement, looking at Chuck.

"History is a record of coincidental happenings and the people who managed to take opportune advantage of them," Armitage observed quietly. "I will not relish what I will have to do in the next few hours."

The Traffic Room of the Control and Inspection Center was large. It was quiet, but it was busy. The several dozen people hardly moved, but the data presentations on the walls were active. Chuck Armitage slumped in a chair behind one of the supervisory desks in the glassed-off gallery. He contemplated the data on the CRT display before him and on the walls of the Traffic Room. It had been a very busy several hours since he had walked in. Several telephone calls had been made. Hot lines between national traffic control centers had been activated on a permanent basis. Tacit agreements had been reached with Chuck's counterparts around the world. Some traffic in the Earth-moon system had been re-routed or re-scheduled; the Department's Public Affairs people kept their cool and announced that the traffic changes were probably caused by the detection of a close-approach planetoid that might be moving near the Earth-moon system. Traffic centers were normally closed to the news media, and they remained sealed off. Some of the news media were enraged; others decided to play it cool and wait for the inevitable leaks or further developments. However, news of wars, revolutions, murders, looting, rapes, invasions, famines, and other commonplace, everyday happenings around the planet continued to occupy the major news slots; after all, those stories were about people, and very few media persons could get very excited about a rock in space.

Chuck Armitage had a decision to make, and he waited until the very last moment to make it. In one smooth motion, he reached out and picked a telephone handset out of its cradle. When he punched the call buttons, his motions were sharp, rapid, and almost vicious. "Tom, Chuck Armitage. It's a 'go' situation, my friend. Let me know whether you or Kim decide to be Number One . . . .Yes, it will be messy . . .I'll take care of that . . . . Good luck, Tom . . .and *arigato*." He put the handset back in its cradle softly. For minutes, he stared straight ahead at nothing.

The telephone blinked at him. He lifted it from its cradle again. "Armitage here . . . . Good, bring them up, George . . . . Yes, everything's going as planned . . . . Well, I'm glad you were able to find him. When will he get here? . . . . Too bad. No latecomers, George. He'll just have to read about it later . . ." After hanging up, he rose and walked slowly to the rear of the room where the bar and the buffet were stocked and ready. He couldn't eat; he didn't have any appetite just then. He wanted a drink, but he didn't dare. He didn't even want the stimulant of coffee.

Over the next thirty minutes, his guests arrived. Some were indignant. Some were quizzical. Some were

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somber. None of them knew the full story, some of them had snatches of data that they had agreed would not be discussed until Chuck had given them a full briefing, but almost all of them sensed that there was an aura of quiet, controlled, constrained terror in the air.

It had taken the full power of the President's office plus that of Secretary Seton to convene every one of the people who arrived. Chuck could not make small talk with any of them; it was impossible for him to do so. He fretted inwardly until the final group of three people came in. The younger of the three came up and shook hands with Chuck.

"Good to see you, Senator," Chuck remarked. "I'm glad you were able to locate Congressman Perrin and bring him with you."

"It wasn't easy," Senator Davidoff replied. "Thanks to TriPlanet, I located Clay with Jeremiah at the Cosmos Club."

Chuck greeted Jeremiah Morris, the scarecrowlike ruler of TriPlanet Spaceways, who said nothing in return. Jeremiah knew the score. A quick telephone call from the Cosmos Club to his operations office did it, and he had passed the information along to Perrin in the aircar enroute to Center. He didn't need to say anything to Chuck at this time; later, when liability had been established, he might make a statement. In any event, a Lloyd's associate would do the sweating. Or so he thought.

"I'm sorry I interrupted your dinner, Congressman," Chuck tried to apologize to Perrin.

Perrin's reply was a growl from an important man who has had his arm twisted. "If it hadn't been for Senator Davidoff, I would have considered this whole matter as a grandstand play resulting from the hearings. I'm still not certain that I . . ."

"Chuck Armitage does not make grandstand plays," the young senator cut in. "I've known him too long to . . ."

"How do we know this isn't a dry run?" Perrin wanted to know.

"I wish to God it were a dry run," was Chuck's reply. Raising his voice above the conversational hubbub of the room, he announced, "Please take a seat, everyone. I want to tell everyone what's going on here."

Most of the people in the room knew each other . . . Star Admiral Jacobs, top man of the Space Watch; Joseph Hirschfeld of TransWorld; Andrew Watermann of Terra-Luna Transport; Jeremiah Morris of TriPlanet; foreign liaison professionals from Europe, Japan, and the Soviet Union; and Secretary Helen Seton, Secretary of the Department of Space Commerce with the gleaming Distinguished Space Star pinned like a brooch to her high-necked tunic covering the scars and prosthetics from the power satellite accident.

"Ladies and gentlemen, you are here at the request of the President of the United States who is fully aware of the crisis that now exists," Chuck began. "George, please get the rest of

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the teleconference on the line. Now, to anticipate some objections concerning national security, I wish to further tell you that I am acting with the full authority and approval of the President in establishing this hologram teleconference with our compatriots in Europe, Singapore and the Soviet Union. Please stand by until George completes the circuits."

The side wall of the room disappeared revealing three more rooms similar to the one they were in. In each of the shimmering three rooms, the holographic projections from Europe, Singapore, and the Soviet Union flickered into being as the circuits through the geosynchronous comsat platforms were given a final tuning. Brief greetings were exchanged, but they were short. The holographic participants seemed to know what the situation was, and they were all business.

"We have a crisis on our hands with worldwide implications," Chuck announced. "Our colleagues elsewhere must participate on a real-time basis. A space vehicle of United States' registry has become a runaway, and it may impact Earth . . ."

The room exploded with voices.

"Gospodin Armitage," the Soviet hologram spoke, causing the room to become quiet, "is it as bad as our information indicates to us?"

Chuck nodded. "Here are the full details. TriPlanet Cargo Load SLZ-420 running in from Pallas at 35,000 tons gross weight did not execute turnover at 1710 Universal Time today. Because of the distance involved, our tracking net did not learn about this for almost two hours. Neither we nor the people at TriPlanet know what is wrong. Telemetry indicated that everything aboard SLZ-420 is operating normally, but the autopilot will not acknowledge nor execute commands. This should not happen with triple-redundant circuits, but it has."

Luxemburg wanted to know, "What is the inspection history?"

"Our records and those of TriPlanet indicate that all systems have undergone periodic inspections as required and that all Spaceworthiness Directives have been complied with. Our Pallas field office gave clearance to boost based on an affirmative preboost check."

"Can we compare computer data?" the Soviet asked.

"Of course," Chuck said and noticed that Star Admiral Jacobs flinched slightly. "Call it up on our standard data transfer net. You can also get the graphic presentation we have on the walls here at Center. At turnover, velocity was 612 kilometers per second, and it is still boosting toward us at one-tenth standard gee. That doesn't sound like much, but it is adding one kilometer per second to its velocity every sixteen minutes and forty seconds."

A few people in the room were rapidly keying display consoles, calling up additional data. But most did not know how. They sat there, responsible for the use of the technology, but unable to manipulate it.

Senator Davidoff broke the silence.

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"But it doesn't seem to be boosting wild. According to the shape of the trajectories you're plotting on the walls out there, its guidance system seems to be working."

"Working perfectly and homing on Earth," Chuck told him.

"Have you alerted the Space Watch?" It was the first time Perrin had spoken since the briefing began. "Can they stop it?"

Chuck indicated the Star Admiral.

Jacobs was young, but he was both a competent engineer and an experienced leader. He first looked directly at the hologram of his Soviet counterpart. Then he turned to Perrin. "No," came the flat answer.

"But you've got an interceptor force!" Perrin complained.

Jacobs glanced at the Soviet hologram. "I am not free to discuss it."

Chuck picked up a telephone. "As Secretary Seton can verify, the President has authorized complete cooperation and the total lifting of security restrictions. Shall I call him to satisfy you?"

Jacobs hesitated.

"Since we began this teleconference, SLZ-420 has added 150 meters per second to its velocity, Admiral," Chuck pointed out, holding up the telephone. "Do you want me to get the President on the line for you, or are you willing to accept what I tell you?"

Jacobs looked at Secretary Seton. "I spoke with the President," she said quietly. "Speak freely, there is no security barrier."

"Our interceptors are Earth-based according to treaty. We've built some slight excess performance into them so that we could operate them de-rated," Jacobs rationalized. "With a very great deal of very good luck and everything working perfectly, we might intercept with a nuke at a range of three hundred kilometers from Earth. But at that point, the SLZ-420 is moving at eight hundred kilometers per second . . . and those rates are beyond . . . are beyond the capabilities of . . . of our intercept system."

"You have exceeded SWAP treaty limitations!" the Soviet hologram objected strongly.

"Gospodin!" Chuck snapped. "I would be very happy now if you had exceeded them to a greater extent!"

"Burn it with your beam weapons at L-5!" Perrin suggested.

"Congressman," Jacobs told him, "those beam weapons won't make a dent in 35,000 tons of iron! By treaty, they're defocused beyond 400,000 kilometers. We can re-focus them in about four days' time . . . which is several days faster than I know my Soviet counterpart can manage. But even if we could re-focus, we haven't got enough time to input enough energy into the target. At the velocity it will be moving, it will take only seven minutes from time of crossing the lunar orbit until it impacts."

"Mein Herr, do you have an impact prediction yet?" was the question from Luxemburg Center.

Chuck paused to key a terminal. "Here's the latest update, Fritz. Barring any malfunction of the

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SLZ-420's guidance system, which is unlikely, the ship will impact near Genk, Belgium, in fifty-nine hours and approximately ten minutes from now. Entry velocity is estimated to be 867 kilometers per second, which means that the Earth's atmosphere will have negligible effect on its mass from ablation or on its impact velocity. The impact will release kinetic energy equivalent to a 284-megaton bomb . . . and we do not know what the effects will be. The atmospheric shock wave will rebound around the planet several times, and the ground shock will certainly go off the top end of the Richter Scale. Some of the 35,000 tons of iron will vaporize on impact, and some of it will get tossed clear around the planet as secondaries . . . some of which may pose a problem to near-Earth orbital facilities. Other than the brief burst of hard X-rays from the atmospheric entry plasma sheath, there will be no radiation other than heat . . . and the fireball of impact will probably rise to the top of the stratosphere and squat there, radiating most of its heat to space. The meteor experts at Flagstaff couldn't even guess the effects on the planetary weather . . ."

"Is there any chance it may go into the Atlantic Ocean instead?" the hologram that was Fritz in Luxemburg asked.

"That just makes it worse," Chuck pointed out. "The impact might vaporize enough sea water to create a worldwide cloud layer . . . which in turn could raise the world temperatures by several degrees by virtue of greenhouse effect . . . . Look, all of you, I just don't know everything that could happen because we have never experienced anything like this in all recorded history! We can't even extrapolate from fairly recent strikes such as the Barringer Crater in Arizona . . . which was made by a small slow-poke in comparison to SLZ-420 . . . ."

There was complete silence for moments as the full import of the information sunk in. It was Claypool Perrin who lost his cool. "We've got to start evacuation of the impact area!"

"Clay," Davidoff said, "an announcement would start a panic."

"But millions of people will die! How can you just sit here and let the sky literally fall on those millions in Europe without telling them?"

"Congressman, will you provide me with some guidelines on how to evacuate a *whole continent*?" Chuck said.

"But *you've got to do something!*" Perrin exploded. "How can you sit here and watch blinking lights and program computers and let the world come to an end? This is madness! *You've* got to do something!"

The people in the room, including the holographic projections, were now looking at one another, often with quick glances, sometimes with long eye contacts. Nobody said a word. Most were afraid to say anything.

Slowly and softly, Chuck broke the heavy silence, "I have already done something about it."

The room exploded again in voices.

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Chuck merely held up his hand, and the room fell silent again. Of all the powerful people in the room, Chuck Armitage was now the most powerful. He turned around and pointed to a screen in the Traffic Room. Two green triangles were now leaving a green trail on the near-Earth display. One of them appeared to be accelerating rapidly. The display had been up for several minutes, but only Chuck had noticed. The others had been far too engrossed in the problem or did not understand the display.

"Madame Secretary," Chuck addressed his boss who, because of her astronaut training, had maintained her cool consideration of the affair. "You know nothing of what I have done. I haven't told you about its planning. I initiated its implementation without your knowledge or approval. I utilized funds from several parts of the budget in such a way that the expenditures wouldn't be noticed until GAO audits us. I'm sorry that I had to do it this way, but I had to protect you and the Department from the storm that is to follow. I accept full and complete responsibility."

"You still haven't told me what you've done, Chuck," Helen Seton pointed out with no trace of emotion.

"First off, here is my resignation, effective immediately." Chuck withdrew an envelope from his jacket pocket and proffered it to his boss.

"We'll discuss it at a later time when things are not so critical," she replied with a wave of her hand, refusing to accept the envelope. "What is going on now?" she asked quietly.

"My grandstand play. Senator Davidoff said a few minutes ago that I don't make them. That is not precisely true. I don't make them until it counts. If I had yelled and made a bloody nuisance of myself over the runaway possibility when I took over here seven years ago, I would not have remained in the position for more than six weeks..."

"That's a very astute observation, Chuck," Davidoff told him.

"I know. Jeremiah, your people combined with those from Trans-World and Terra-Luna would never live with any system that could reach into deep space. Neither would the League of Free Traders..."

"Don't try to put the blame for all of this on us, Armitage," Jeremiah Morris growled. "Because of your unreasonable regulations, we've had to put safety devices on the safety devices . . . and something was bound to go wrong sooner or . . ."

"Gentlemen!" Helen Seton's voice was still quiet, but it carried both leadership and authority in its tone. "Please! There will be ample time for bickering later . . . if we survive. Let Chuck explain what it is that he has done behind the scenes."

"Thank you. I did a bootleg engineering job that is something far less than perfect with high risk involved and exorbitant ultimate cost . . . hoping that I would never have to use it because others might be convinced to give us the means to do it right. Well, SLZ-420 forced the issue and pushed

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me into using my Plan B which is one-shot. We can never use it again, so we've got to get our heads together even while it is probably saving our necks . . . which is why the President acceded to my requests to bring you together here."

Perrin was on his feet, using his full-volumed House speaking voice. "I will not permit myself to be pressured in this manner . . . . Please excuse me!"

"You will have some trouble getting out of here," Chuck Armitage pointed out. "Madame Secretary, do I not have the authority to seal off the Center in an emergency?"

"You do, and I will not countermand your order. But I would really like to know what you are doing, Chuck. All of this preamble obviously seems important, and it probably is. But SLZ-420 is coming down our throats, and that is Priority Number One. *Will everybody please be quiet and listen*?" When she raised her voice with emotion in it, the shock rippled through the room which instantly became silent.

Chuck spun a chair around and literally fell into it. Fatigue was beginning to get to him, and there was a long time yet to go. "Those two green triangles boosting hard away from Earth are two of our deep space inspection cutters from Hilo Base, Hawaii. They have been highly modified and each is manned only by a single pilot."

"Manned? Why manned?" Star Admiral Jacobs wanted to know.

"Because we had neither the time nor the money to develop the necessary long-range active guidance and homing systems that are required for an interceptor that can handle high closure rates at distances far beyond lunar orbit," Chuck explained. "I had to use a guidance system that was already available: a human being. The first triangle represents the cutter *Toryu*, which is boosting at four standard gees, the limit of sustained human endurance, under the control of Tomio Hattori. The second triangle represents the *Shoki* boosting at two standard gee under the control of Kimsuki Kusabake. In approximately twenty-five hours, the *Toryu* will intercept the SLZ-420. If Tom Hattori does the kind of job I know he can do, the impact of that 2000-ton cutter will do one or both of two jobs: deflect the SLZ-420 from its present trajectory and/or disable its constant-boost drive. If Tom doesn't do the complete job, we have the *Shoki* following with Kim to finish it off . . . but that will be a tough one because of the increased closure rate . . ."

Again, it was Congressman Claypool Perrin, the re-elected romantic of the let-it-all-hang-out Seventies, who broke in almost hysterically, "Do you mean to tell us that you have deliberately sent at least one person to a certain death? How can you possibly do this . . . this *inhumane* thing?"

"I know of no other way to do it at this time with the tools that you have permitted me," Chuck fired back. "And spare me the outrage. Ain't nobody here but us chickens, fellas . . .

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and that is an American folk saying for the benefit of our teleconferencing guests. Every one of us in this room, including the teleconferencing guests, has contributed to this situation in his own unique way."

"Now, that certainly isn't true, Chuck! This should have been a Space Watch job . . ." Star Admiral Jacobs started to say.

"See what I mean?" Chuck said. "The Watch fought us tooth and nail when we instituted orbital sweeping for the thousands of dead satellites up there. No, they wanted high-power beam weapons installed in L-5 to do the job . . . And I know that your intelligence people knew that, Dimitri!"

"That's not a fair assessment!" Jacobs tried to break in. "The State Department didn't . . ."

"I don't care who tries to put the blame on who!" Chuck said in exasperation. "Governments, private enterprise, everyone involved in space commerce is right here, right now! Reading it on the news tube wouldn't have helped toward a solution; you had to be here right in the middle of it living with the consequences of your actions. You had to see and experience it, and it is a very difficult thing to do. And please don't think that taking care of this industrial accident was an easy thing for me to do, either!" He sighed deeply and rubbed his eyes. "But it *will* be an easy thing for Tom and Kim."

InTimesToCome

● It's not often that I see a piece which is both a good horror story and good science fiction, but that's what George R.R. Martin has produced in April's lead story, "Nightflyers." Consider an expedition traveling *deep* into space in search of an elusive alien artifact (or *was* it an artifact?) known only from legends. But the strangest thing they found was aboard the ship they rode. Paul Lehr's cover is more beautiful than sinister—but the story itself you might not want to read alone and late at night.

Our 'fact article' is something a little different. It *looks* like a fact article—an encyclopedia excerpt, to be precise—and it does indeed contain a lot of fascinating facts from the contemporary arsenal of physics and astronomy. But it's dated 2056, and some of the details haven't happened yet. Life on a neutron star, with half the mass of the sun packed into 20 kilometers? Possibly—and it would necessarily be *quite* different from the kinds we know. Could we visit it? Maybe, if we were clever enough. Such is the basis of Dr. Robert L. Forward's novel, *Dragon's Egg*. Logistical problems made it impossible for us to serialize the book, but its world is such an intriguing place we had to tell you something about it.

In addition, we'll have the second part of Bob Buckley's *World in the Clouds*, plus the usual variety of features and short stories—including a new short story, "Grotto of the Dancing Deer," by Clifford D. Simak.

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"What do you mean, Chuck?" Senator Davidoff asked.

"Admiral Jacobs knows what I mean. There are always people who are willing to sacrifice themselves for the greater good. Some people seek self-destruction for a cause in order to give meaning to their lives. Our psychologists can spot them. And sometimes it is a cultural trait . . ."

"Kamikazes," Jacobs muttered.

"Over two thousand pilots of World War II, and several thousand from time to time since then in suicide missions in brush-fire wars for a glorious cause greater than they believe themselves to be." Chuck noticed that Perrin was now shaking his head in total disbelief. "No, Congressman Perrin, this job isn't all technology. It deals with people because technical problems are rarely unsolved due to technical factors. In this case, I am giving two people the opportunity to fulfill themselves. Tom and Kim are out there by their own free choice. I have been the only one who did not have a real choice."

Most of the people present in the room sat aghast with three exceptions—the hologram from Singapore whose Japanese features indicated full understanding, Secretary Helen Seton whose own sacrifice on PowerSat One had made her life as a woman and mother impossible, and Star Admiral Jacobs who nodded as though he had discovered in Chuck Armitage a man he could fully understand. "We have them in the Space Watch, too. No military establishment could exist without them," he said, with pride.

It was now very quiet in the room again. Armitage looked around. "We have twenty-five hours before we know if Tom Hattori succeeds. In the meantime, we have placed the tightest possible worldwide news lid on this. There will be no leaks from Singapore or from the Centers. Food and beverages will be available here, and there are secure rooms down the hall if anyone needs to rest. Your respective organizations have been notified that you are in a special international conference, which is no lie. We have all seen the consequences of our past activities. We now have the unique opportunity to work out an arrangement so that this sort of thing can never happen again. Madame Secretary, you are the logical one to chair this *ad hoc* conference. Would you care for some coffee?"

Tom Hattori and the *Toryu* did the job. The haggard group in the gallery of the Center watched the displays as what was left careened around the Earth and plunged outward forever into deep space with a velocity that would take it to the stars. There were no cheers. The conference group was far too exhausted physically and emotionally. New agreements had been hammered out. A joint communique had been written and released to the news media.

Both in space and in the Center, the solutions were compromises . . . but workable compromises.

Chuck Armitage was the first to leave the Center.

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He discovered Senator Davidoff and Secretary Seton walking on either side of him.

"Where are you going, Chuck?" Helen Seton asked.

"Home. To stay."

"Take a few days rest. Then come and see me. There's work to be done . . . lots of work."

"Madame Secretary . . . Helen . . . my resignation holds. It has to."

"Chuck, you're a good man," Senator Davidoff put in. "We've always needed good men. Why do you think you're finished in your present position? With the new agreements, we need you more than ever. You were the spark plug that got it all together for us."

"Ah, my dear colleague from the good old days of the Shuttle missions," Chuck Armitage replied. "Perhaps you and Helen can handle the political aspects of this and swing enough clout with GAO so that Justice does not indict me for misappropriation of funds . . ."

"But you saved the whole damned world!" Davidoff pointed out.

"Temporarily . . . until the next crisis in an era of crises."

"I can't be as dramatic as the Senator," the petite Secretary of Space Commerce remarked, "but he's right. We need you more than ever. When forced to make a decision, you didn't waffle . . . and it was a very tough decision. Both the Senator and I know such a thing is rare among people today but absolutely necessary in space. Chuck, your career and job are not in jeopardy. I'll stick by you, whatever happens . . ."

"And I will do the same," Davidoff added quickly, earnestly.

Chuck stopped walking so suddenly that his two companions went two steps beyond him, then turned to face where he stood. "No. For several reasons. You're on top of the hill, and I am down on a ridge. I see some things differently. I pushed around a lot of internationally powerful and influential people. I rubbed their noses in their own accumulated folly and made them admit to it by forcing them to come up with a new set of rules. I'll never be one of them and I'll no longer be able to work for them because I have proved that I am willing to rock the boat and make big waves. I am no longer to be trusted . . ."

"Nonsense!" Davidoff snorted.

"You know it isn't. I cannot ask you to risk your own careers. I've already sent one man to his willing destruction; I cannot ask anyone else to even risk it. In fact, my own personal values are making it very difficult for me to rationalize Tomio Hattori. In my own case, it doesn't count. When I spoke of people willing to sacrifice themselves for a greater cause, I knew exactly what I was talking about . . . . Now, please excuse me. I'm very tired . . ."

He turned and took a side path, walking away from them. In the star-specked evening, the ex-astronaut senator and the ex-astronaut minister watched him go. There wasn't anything either of them could say. ■

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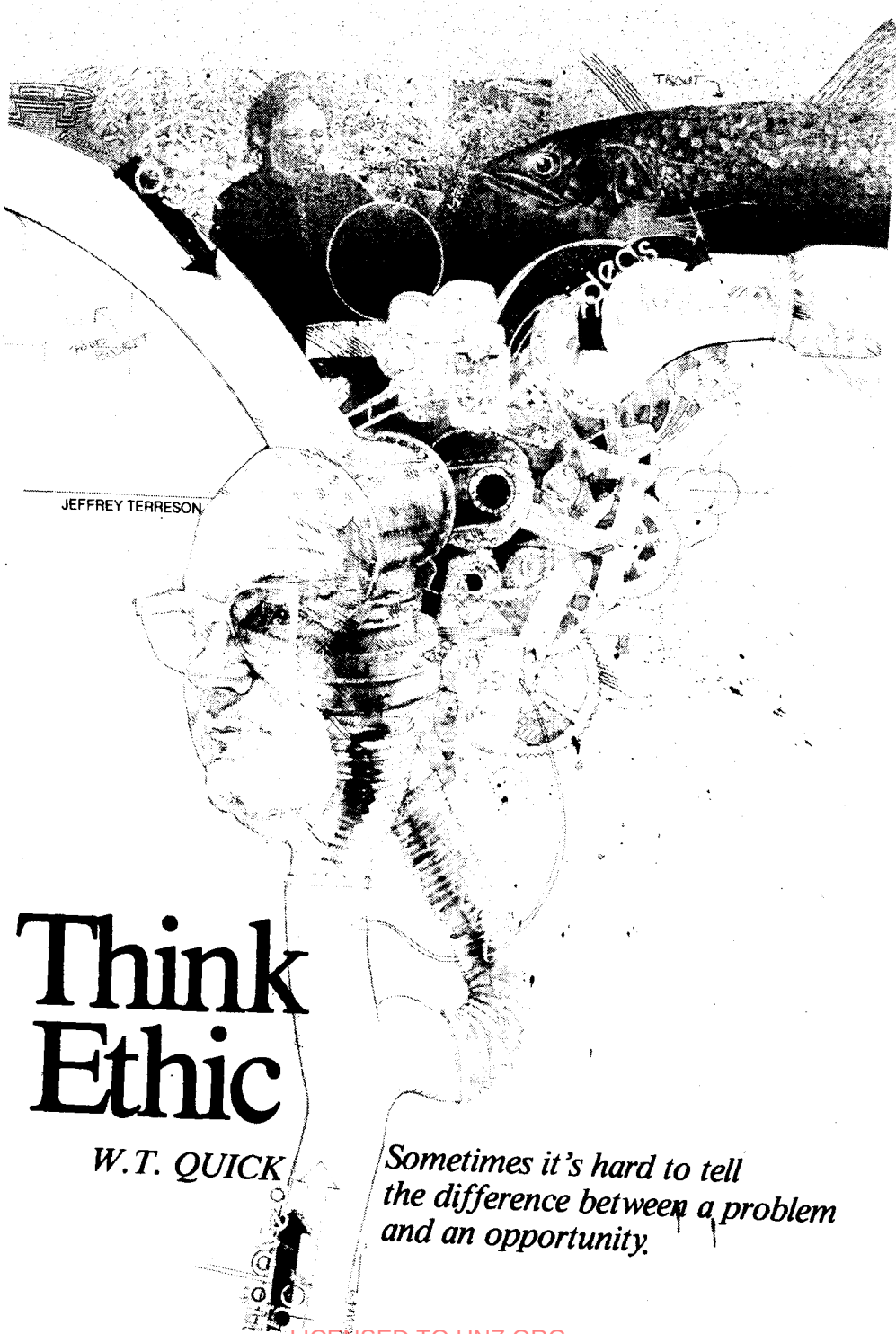

Think Ethic

W.T. QUICK

Sometimes it's hard to tell the difference between a problem and an opportunity.

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R Perrin Parker, "Bob" to his friends, poured himself a double scotch, and wished for a moment that ulcers were still around. If he could get one, he could take a few days off. He tossed down the potent liquor and turned to face his current problem.

"Now, listen, Chubby," he said to the opulently corpulent man who sat in a disguised massagechair in front of his desk. "with everything else on my plate you're not really going to do this to me, are you?"

Chubby, known to the public as Lawrence F. A. Cabot, Chairman of the Board of General Electric Motors, smiled happily and said, "Yes, I am. I've wanted to for a long time, and now I'm going to. Today."

"But you can't lay off three quarters of your work force. Nobody in Detroit will have a job."

Still nodding cheerfully, Cabot said, "Yes, I can. Man, I can't wait to see old Nottingwell's face. Man." Old Nottingwell was the head of the United Auto Workers. "He'll have apoplexy. I wonder if it's fatal?" Cabot didn't sound much disturbed by the prospect.

"Not that old bird. He's meaner than you are. But Chubby, *I* will. I'll have apoplexy right here and die on this floor and it'll be your fault."

"Oh, come on, Bob. It's happened before. You coped then, and I'm sure you will now." He grinned. "After all, you *are* the head of the Office for Economic Opportunity. A blazing star in the governmental firmament, I recall," he quoted from some long-forgotten column.

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"At this rate, I'm going to be a black hole," Parker said sourly. "I suppose there's nothing I can say to change your mind?"

"Nope. Listen, I just wanted to let you know. So you could hit the storm cellar, or whatever. But I've got to run—I've got a press conference in two hours. And," as his Palm Beach tan split in an ear-to-ear showing of teeth, "Nottingwell will be there."

"Okay, go on. Get out of here. You've ruined my day already, now go have some more fun. I hope Nottingwell *does* get apoplexy, so I won't be the only one. Go ahead, git."

After Cabot's departure, Parker grabbed a pocket computer and did some fast figuring. Mmm. Ouch. The unemployment rate would be hovering, as the press boys liked to say, around forty-six percent.

He pressed a button on his desk console. "Miss Hanley, would you get your pretty little whatsis in here right away? We've got work to do."

The fact that it had only taken him two hours to get through President Neely's phalanx of public relations guards, secretaries, and assistants hadn't really improved his mood. Mostly because the goal of all that effort was Neely himself, a man elected on the strength of several dozen perfect teeth and a good golf game.

Now Neely nodded his silver head and said, "Cabot. Yes. Sound man. Sound golfer. Sound."

"Mr. President, he's laying off two million people. Two *million,* sir."

"That's a lot, isn't it? Sizable, eh? I suppose everybody will blame me?"

"It won't do you any good, sir."

"Well, fix it, Bob. Okay? Fix it for me and we'll see about a few more perks for you. A branch office in the Bahamas, hm? Like that, would you?"

At times, Bob Parker wondered about the survival potential of democracy. "Sir, that's not the problem," he said.

"Well, what is? I just don't understand. Why would Cabot want to do a thing like that anyway? Sound golfer like him?"

Parker knew it was hopeless to explain, but he tried one more time. "Sir, it's fairly simple. Integrated management, the computer and the orbiting space colonies shoved us into a third industrial revolution. Our GNP tripled, then tripled again, through increased management efficiency, automation, new sources of energy. We simply don't need the manpower we once did. I can see Cabot's position—he could've gotten rid of those people five years ago, and increased his productivity by so doing. Evidently pressure from his stockholders finally outweighed our own political influence."

"Well, whatever," Neely grumped. "Now, listen, I've got a golf game shortly. I don't want those people yelling at me. You do something to fix it. Okay? That's a good fellow."

"I'll try, Mr. President," Parker said helplessly.

"Do better than that, would you? With all those people out of work, I'm

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sure one of them would want your job. Heh, heh. That's a joke, Bob."

Back in his office, Parker wondered if that wasn't the best solution—he'd worked three long, hard years and still felt as if he was pushing a boulder uphill. There had to be a solution somewhere, and letting a copy of Neely have this office wasn't the answer.

The problem was real enough. His own private projections showed unemployment topping seventy percent within five years. And all the easy solutions had been tried—the government certainly wasn't short of money. Last year's budget surplus had surpassed two trillion dollars, and that with the freest spending Congress in American history.

At first, they'd tried WPA-type programs, but there were only so many dams, parks and roads needed. Then, straight doles which, though still in force, left something in the average man unfilled—the work ethic was stronger than anybody figured.

Nobody starved. In fact, those laid-off workers would make more money than before, from the various government programs—that wasn't the problem either. People wanted meaningful work, and there just wasn't enough to go around.

He sighed, rubbed his forehead and glared at the stack of incoming messages impaled on his old-fashioned spike, and thought. There *had* to be an answer.

Miss Hanley undulated in. "Sir, I've been fielding all calls, but there's been one very persistent person. Rude, too, I might add. I thought I'd let you know."

"Okay. Who is it this time?"

"Marcus Paine."

"Oh, Lord. Put him through." As he waited for his visiphone to light up, he thought about Marcus Paine, the perfect end to a perfect day. Lawyer, one-time congressman, now leader of the People's Lobby, which was a huge, busybody organization dedicated to making life miserable for every working bureaucrat. And keeping Marcus Paine in the limelight, Parker reflected.

"Hello, Marcus," he said to the handsome, distinguished face on his phonescreen. "And to what do I owe the pleasure?"

"Mr. Secretary," Paine said ominously, "what do you intend to do about this latest outrage?"

Parker grinned. "Marc, this line is scrambled, and I'm alone. Tone it down a bit. What outrage?"

Paine's stern features relaxed. "Chubby Cabot's new employment plan, of course. What are you going to do about it?"

"I already did it. Talked to him this morning. He wouldn't change his mind. All he could think about was the look on Nottingwell's face."

"That's it? That's all you're going to do?"

"Marc, this is off the record, but you know as well as I it's all I *can* do. What do you think, I'm going to call out the Marines and bayonet Cabot into keeping all those people on?"

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"Well, economic sanctions, political pressure, a little jawboning..."

"General Electric Motors is richer than the government, almost, what with their orbiting factories and everything. What economic pressure? As for political pressure, that's all that's held him down till now. Since he's decided to go ahead, he must have discounted it already. And for jawboning, sure, I'll go on the networks tomorrow and politely call him every dirty name I can think of. But my heart won't be in it."

"Mm. That's it, huh? Well, Bobby, I hate to ruin your day any further, but *I'm* going to do something."

"You want to tell me, or is it going to be a surprise?"

"Nope. You know those two million unemployed auto workers? Well, me and Stan Nottingwell are going to lead them in a march on Washington. Then we're going to camp out on Neely's favorite golf course until we get some action on this."

"That's truly rotten of you, Marc. What do you want, my job? If so, you got it, the way I feel right now."

Paine grinned. "What would I want your job for? I'd have to work. I want Neely's job, where all I have to do is look pretty. So, now you know. Bye." The screen blinked out.

Parker felt the beginnings of a major headache dancing ponderously behind his eyes. Wearily, he punched his intercom again. "Miss Hanley, would you have Mike Peters come in, please? And hold *all* calls until we're done? Thank you."

Peters, his Assistant Secretary for Policy and Planning, was a cheerful, rosy-cheeked youth with all the basic instincts of a rabid wolverine. He handled Parker's nastier political chores. He bubbled into the office, perched on the corner of Parker's desk, and said, "Afternoon, boss. How do you want the bodies? Buried, or twisting in the wind?"

"Hi, Mike. Nothing like that. I'm going to have to do something about this G.E.M. thing, is all."

"Yeah? Should I get Chubby Cabot's *personal* file? The one with the pictures?"

"No. It's too late for that, anyway. I'm going to set up a new program, funnel some more money into Detroit. How much is in the contingency fund?"

"About ninety billion, I guess."

"Okay, scoot over to the Hill and twist an emergency hundred-billion appropriation out of them."

"Aw, that's like taking candy from a baby. Don't you have anything tougher for me?"

"In a minute. Listen, organize a new recreation program for Detroit. They bowl out there, don't they? And I heard boxing-chess was catching on. Maybe we can take their minds off these layoffs with enough publicity on a new program."

"Consider it done."

"Oh, yes, another thing—get me some real dirt on Paine. Never can tell when it might come in handy."

Peter's innocent, boyish visage lit up. "Now *that*, I'll enjoy. Anything

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else you want?"

"If I think of it, I'll let you know. Okay, get going."

Parker watched the sunset turn Washington into a pink and shadowed fairyland and wondered if any of this would do any good. Somehow, he didn't think so.

He was right.

Three days later, he was again looking at the face of President Neely. Good thing his public couldn't see him now, Parker thought. All those Presidential veins in his nose stand out when he's mad.

"Parker!"

"Yes, sir."

"There are two million crazed auto workers marching on Washington. They say they're going to camp on Burning Pines. That's my favorite golf course."

"Yes, sir."

"Paine and Nottingwell spend half their time on the national networks. When one of them isn't calling *you* a bumbling, incompetent fool, the other one is calling *me* the same thing!"

"Yes, sir."

"The latest polls show my popularity in negative numbers!"

"Yes, sir."

"There's an election next year. In case you didn't know, I plan to run."

"Yes, sir."

"Well? Is that all you can say?"

"No, sir."

"Dammit, I told you to fix things. Now I want you to get out there and *do* it. You understand me, Mr. Secretary? Fix it immediately!"

"Yes, sir. Is that all, sir?"

"Yes." The President looked down at his desk, but as Parker reached the door of the office, he looked up again.

"Parker."

"Yes?"

"There are worse things than being unemployed. I'm sure somebody on my staff could dream up one of them for you."

"Yes, sir," Parker said miserably, as he quietly shut the door.

Late that evening, alone in his office, he threw yet another draft of his resignation at the wall.

"Dammit," he said, "not yet. I'm not going to quit yet!"

He knuckled his tired, burning eyes. His mind whirled. He felt leaden, whipped, empty. He knew it was mostly the strain of the last few days, but still, all he wanted to do was crawl into bed and sleep forever.

His eyes widened. Sure, why the hell not? He picked up the mike to Miss Hanley's message tape. "Miss Hanley," he said, "I'll be gone for a couple days. Don't tell anybody where I am, even if it's President Neely. *Especially* if it's President Neely. Come to think of it, that won't be a problem. You won't know where because I'm not going to tell you! Bye."

He made it to Dulles within the hour, and five hours after that he opened the door of a small cabin in the Colorado Rockies, a place he'd kept from his private days, still unlisted on any government locator sheet.

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Further down the mountain he could see the faint lights from the artists' colony that had been there for years. The air tasted crisp and clean. The stars were spilled like first-water diamonds across the sky. Best of all, there wasn't a politician within miles. Feeling the tension of the last days fall away, he went inside, turned on lights, the ancient frig, and the equally antique stereo—then he opened a bottle of single malt scotch, sprawled on the ratty sofa, and got blind drunk.

The next day he awoke to the sound of birds singing. He ached all over, his head rang like the Liberty Bell, and he felt better than he had in years.

He got up, winced, took two aspirins, decided against breakfast in favor of a walk, and began to whistle. Surprisingly, after a shower and a change of clothes, he felt quite human. Still, there was enough of a hangover to lead his path downhill instead of up.

Everything got progressively better as he hiked along, savoring the sparkling air, the emerald pines, the feel of honest dirt beneath his feet, so that when he turned a bend in the trail and came upon a teenaged boy perched on a rickety split-rail fence, he said cheerfully, "Hi. Great morning, isn't it?"

The slender, dark-haired youth looked up, startled. "Huh? Oh. Yeah, it is, isn't it?"

Overflowing with good will, as well as the yearning for conversation with somebody who didn't know a politician from a pumpkin pie, Parker continued, "Son, if you spent all your time in a slave pit the way I do, you'd appreciate all this a little more." He paused. "You live around here?"

The boy jerked one grimy thumb over his shoulder. "Yep. The colony. Back up the path there."

"Oh? You an artist?"

"Well, sort of. I mean, I fool around with acrylics and like that, but I'm really into other stuff."

"Other stuff? Like what."

The boy finally seemed to really notice him. "Really want to know?"

Remembering the painful shyness of his own childhood, Parker said, "I asked, didn't I?"

"Well, I collect herbs. And classify them, and experiment a little."

"Herbs? You mean weeds and such-like?"

"They're *not* weeds—at least not in the sense that people think weeds are useless. Herbs are good for *lots* of things. See, when I was a kid, I read this viewtape about Indian medicine men, and it just bugged me that they seemed to know a lot more about herbs than we do."

Something nibbled invitingly at Parker's mind. "Herbs, hm? Been doing this long?"

"Three or four years, now."

"That's quite a while."

"Not really," the boy said seriously. "With the collecting, the classifying, and the testing, I could spend a hundred years. Not to say if I could get my hands on *good* equipment."

The nibble was turning into a persistent bite. "Say," Parker said, "is the colony open to visitors?"

"Sure. You want me to take you

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up and show you around?"

"Yes. I'd like that a lot."

Two days later, Parker breezed into his office, trailing an agitated Miss Hanley in his wake. "The President's frantic and Mr. Paine's been calling constantly, and—"

"Stuff it," Parker cut her off.

"What?"

"You heard me. Get Mike Peters in here, chop-chop, and stop all calls."

Peters was his usual jolly self. "Welcome back, boss."

"Hi, Mike. Do you still keep that stable of morons to write legislation for you?"

"Sure."

"Okay. I may have solved our unemployment crisis, but the solution could cause more trouble than the problem itself."

Peters' cherubic countenance brightened. "Great! I love problems. What—and who—are they?"

"Let's see. Marcus Paine and Stan Nottingwell, probably. President Neely, too. Most of the people who are still working. Quite a lot of those who aren't. And the Congress. Chubby Cabot and his friends." He sighed heavily. "And the ingrained habits of several hundred years..."

During this litany, the aide's face gradually fell. Finally, the young man shook his head. "Boss," he said. "What are you planning to do? Overthrow the Republic?"

Parker's breezy manner disappeared, as for the first time he faced the enormity of the problem. "I don't know," he said slowly. "I hadn't thought of that."

One of the things about being a top level bureaucrat, Bob Parker mused to himself, was that eventually you learned your way around the government. It was a comforting thought as he sprawled in a deep, old-fashioned leather chair before the massive oak desk of Hawthorne Monroe, majority leader of the Senate.

Viewed through a haze of expensive cigar smoke, Monroe appeared as a harmless, pewter-haired elf. Parker knew better. The dapper little politician had long retired the cliché "Grand Old Man," and was now writing new meanings for "Statesman." Monroe's affected southern drawl and his antique mode of dress were props. His mind was a trap, his power immense, and Parker had no intention of trying any funny stuff with him.

Now Monroe exhaled a huge cloud of blue smoke and waved the cigar back and forth. "Bob" he said, "I've helped you with some little things in the past, but mebbe this time you've chewed off more tobacca than you can spit, as the good ol' boy said."

Parker leaned forward earnestly. "Senator, the problem is that we've got two values for the work ethic. One is intrinsic, that is, people feel that work itself is a good thing. Many even define themselves by what they do, as, 'I'm a steelworker,' or, 'I'm an accountant.' You see?"

"Work as an end in itself," the

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senator huffed. His eyes narrowed. "I'm not a fool, boy. Go on."

"Um. Sorry, sir. Well, as I say, that *appears* to be our main problem. When people are thrown out of work, they lose the foundations of their lives. They feel useless."

"Yes..."

"The average man doesn't often think of the second value. But his boss sure does. Work is instrumental. It's a means to an end, and that end is the production of something. Our real problem is that machines can produce things more efficiently than men."

Senator Monroe pointed his cigar at Parker like a spear. "'Pears to me, son, that you've just described an unbeatable problem. People cain't do what they want, cause they cain't do it well enough. Mebbe you can see a way out of that?"

"Yes, I do," Parker said quietly. "And all we have to do, Senator, is change the product."

Chubby Cabot was still burbling. "Bob, did you *see* Nottingwell's face? I loved it! Thought the stringy old coot couldn't get any madder, but he did. He sure did."

They were in Parker's office. He sat behind his desk, chin cupped in hand, and listened to the muted roar of two million auto workers milling through the streets of Washington. "Chubby, curb your enthusiasm," he said. "It's giving me a headache."

Cabot grinned. "I'm not giving you a headache, Bob," he replied. "That mob outside is, though. Is that what you wanted to see me about?"

Parker leaned back in his chair and studied the corporation mogul. Chubby Cabot occasionally played the role of buffoon, but Parker knew that he hadn't risen to the top of one of the world's most powerful corporations by being anything less than shrewd. It was said that Cabot could smell a gimmicked balance sheet a thousand yards away, and his loyalty to his stockholders was legendary. A tough nut to crack.

"Chubby, I've got an idea that might solve this unemployment crisis, but I need your help."

The fat man cracked his knuckles as his face assumed a thoughtful look. "Bob, I can't call those workers back. You know that."

"I know. But listen to this." Parker outlined his plan. Finally, he finished and put both elbows on his desk. "Well, what do you think?"

"I think that it's a chrome-plated bitch," Cabot said. "But it has possibilities. Okay, let's get to the profit-loss sheet. You say you want to keep individual taxes at the same level. Who picks up the slack? Us, again?"

Parker forced himself to remain calm. "That's right, Chubby. I figured you'd catch that part. But look—most of the bite for the new program would be picked up by increased industrial demand. Computers and classrooms and research facilities don't come cheap. You and your fellow industrialists would get a whole shit-pile of new orders."

Cabot shifted uncomfortably.

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"Sounds to me like you're robbing Peter to pay Paul. Sure, we'd get the contracts. Who else? But higher corporate taxes to pay for it all? I don't know, Bob."

"Okay. Well. It may sound pie-in-the-sky, but anything this massive is bound to spin off marketable results. Maybe whole new industries. It's like the old space program. People screamed at the cost, but you aren't screaming now. In fact, it was the industrial community that rescued the whole idea of space travel, once you found profit in the orbiting factories."

Cabot rubbed his chin. "That's true. But it wasn't easy. You should have seen the fight I had getting G.E.M. to go ahead with the first experimental plant."

Parker smiled. "I remember, Chubby. Lopped off a few heads on that one, didn't you? But the possibilities are there. And the potential profits are immense."

Cabot spread his big hands. "Well, Bob, I wish you could give me something really substantial, something I could show to my board."

"How about my unofficial promise of two hundred billion in advance orders?"

"Better than nothing. It might work, Bob. I'll give it a shot. But I'd feel a lot better if you had something concrete for me to work with."

"I know, Chubby. I'll try."

Stanley Nottingwell was clearly annoyed. "I shouldn't even be talking to you, Parker," he grumped. His cadaverous frame made a one-skeleton parade back and forth in front of Parker's desk. He glared as he halted and faced the government man. "I represent my workers; that puts us in an adversary position. And I'm not looking for a secret deal!"

"Mr. Nottingwell, I know you're not. For that matter, I'm not offering one. But let's face facts. Those men of yours aren't going back to work for General Electric Motors. The question is, what do we do about them? Do you have an answer besides marching them back and forth across President Neely's favorite golf course?"

Nottingwell locked his fiery gaze with Parker. For a moment their eyes held. Then the union man lowered his head. "Well, some sort of help from the government. Some kind of pressure on—"

"Bullshit!" Parker interjected. Although he didn't know Nottingwell personally, he remembered the man had a liking for plain words and straight talk. "That stuff is useless with the problem we've got now!" Then his voice softened. "But what about an idea that goes to the root of the problem? Would you be interested in an idea like that?"

The old man sat down suddenly. "Yes," he said. "I'd be very much interested in an idea like that."

Later, Nottingwell clutched a bottle of beer and Parker sipped at a scotch while they tackled the problems. Somewhere in the previous two hours they'd gotten on a first name basis, and Nottingwell was almost mellow as

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he said, "I see two problems, Bob. First, what about those people still employed? Some are necessary where they are. How do we keep them from joining your new program?"

Parker turned from the window where he'd been admiring the Washington sunset. "We don't," he said. "The program has to be open to everybody. But, have you ever heard of an indispensible man?"

Nottingwell shook his head. "Nope. Not really."

"I figure," Parker said, "that a lot of people won't take to the new program immediately. They'll jump for job openings when they appear."

"What if more people want old-style jobs than there are openings?"

"You can't make an omelet without breaking eggs, Stan. But at least they'll have an alternative. My program is that alternative."

"Mm. Still might be a problem. But short term, and less than what we've got now. Okay. How about the loafers? We could spend a lot of money to give some guy a place to hang out."

"The same answer applies. They can be a part of the program. How would we screen it, anyway? Still, sometimes a loafer turns into a worker with the right incentive. Industry will pay for good ideas, you know."

"Could be," Nottingwell admitted.

"As I say, there are problems to be ironed out. That's what I'm trying to do now. You aren't the only guy I've talked to."

Nottingwell grinned. It made him look much younger. "I'll bet. What does Cabot have to say?"

"He's dubious about increased corporate taxes. Wants something to give his board."

The union leader stared thoughtfully at the ceiling. He gulped the rest of his beer and set the empty bottle on Parker's desk. "Bob," he said, "how about giving him a lower labor cost?"

Parker's eyes widened. "What?"

"You've convinced me. I think your idea will work. You see, I'm in a different position than those other guys. I've seen my constituency shrink as the reason for it withers away. And I've wondered what we do when there's no work left at all. In a way, it's a self-solving problem. The next generation will think of our kind of work the same way we regard hunting wild animals for a living. Interesting, but archaic. Which doesn't help now. Your idea can help, and I've decided to back you up. So. I think I could guarantee Chubby Cabot and his buddies low enough contracts to offset the increased taxes."

"You'd do that?"

"Yes. I'd been planning to raise costs drastically because of smaller labor force. Those remaining workers are *necessary,* you know. But I'll sell them on a little increase instead of a great big one. They trust me. I think they'll go along."

For the first time since he'd talked with Mike Peters, Parker grinned. "Stan," he said. "Can I get you another beer?"

"Have you seen the President yet?"

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Peters asked his boss.

Bob Parker glanced up from the sheaf of papers he was studying. "What? Oh, not since I got back."

"You should. His bully boys are starting to give me the cold shoulder. Maybe they know something."

Parker sighed. "Okay. I'll give him a call. Does he know I'm in town?"

"For sure. You've been talking to a lot of important people."

"Yeah. Say, this slogan your boys dreamed up is pretty good. 'THINK. IT'S HARD WORK!' I like it. Where did you ever get it?"

Peters smiled nastily. "I got it free. An adman owed me a favor."

"Sometimes I think you enjoy doing things the hard way. You could have just payed him for it."

"Gotta keep in practice, boss. Anyway, the pilot program for Denver is all set. Full media presentation, test facilities, staffing, all of it. I borrowed corporate computer time to handle the initial correlations. Who knows? We might strike it rich right out of the box."

Parker stretched, then stood up and walked from behind his desk. "Okay, Mike, get it started. If you need more computer capacity, talk to Chubby Cabot. But talk nice. He's on our side, I think."

"Will do."

"Boy, I'm tired." Parker massaged his aching forehead. "And the worst is yet to come. Set up a meeting in the main conference room for next Wednesday. Miss Hanley has the names. Let's see, that'll give me five days. Can we get a valid response from Denver by then?"

"I think so."

"Good. On your way out, have Miss Hanley patch me through to Neely. I might as well get it over with."

President Neely's face was bright red. "Parker, you've gone too far. You're fired!"

"Oh?" Parker said coolly. "Then you don't want to know about a new program that might solve the unemployment problem once and for all? And, incidentally, make your reelection a lead pipe cinch?"

"You're rehired," Neely said quickly. "Now, tell me all about it."

For a moment, Bob Parker was alone in the small anteroom outside the main conference area. Inside, several of the most powerful men in the world were gathered to hear his full presentation. He felt exhausted. His father had once told him that the road to political success was paved with honey. Give everybody what they wanted, and they'd give you the same. He'd tried to do that. Tried to give all of them something, and still keep his idea intact. Now, faced with the final test, he quailed. What if they rejected it? What if he'd made a mistake somewhere? What if—? Suddenly a sort of icy fatalism overtook him. He inhaled deeply, set his shoulders, and walked into the conference area.

The plush interior of the large room nearly overwhelmed him. But then, it was designed to do that. A thick, blue-gray haze of smoke hovered near the

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ceiling. Muted conversation rose from small clots of men gathered by special interest. Two secret service men, presidential bodyguards, eyed him briefly before returning their attention to Neely, who was talking with Chubby Cabot. Most of the men held drinks. Silent waiters circulated through the crowd, offering fresh cocktails. It was as he'd planned. The cocktail hour, the conversation, the deliciously tiny hors d'ouvres were all intended to put this gathering of suspicious men at ease. If such a thing were possible.

Parker moved further into the conference room. Almost immediately someone touched his shoulder.

"Parker!"

It was Marcus Paine, his handsome features twisted in a feral scowl.

"Yes, Marc, what is it?" Parker said quietly.

"That's a good question, Mr. Secretary," Paine said tightly. "But shouldn't I be the one to ask? What is it when Stan Nottingwell sends the auto workers home and then refuses to see me or even take my calls? The two of you are pulling a fast one, Bob, but you won't get away with it. I have some influence myself, and—"

Parker stepped away from the man's heated words. Already curious glances were coming their way. "It's not a conspiracy, Marc," Parker said. "I invited you, didn't I? Just hang on. My presentation will explain everything. I promise."

"Well..." Paine was unhappy, but he stepped aside. After the obligatory period of handshaking and smiling, Parker went to the head of the long conference table and faced parallel lines of expectant faces.

"Gentlemen," he began, " the documents before you detail my program. In essence, I propose establishing a new, cabinet-level agency, to be called the Office for Creative Development."

Grunts of interest mingled with the rustle of turning pages.

"Most of you have been told part of the idea. Now I'll try to give you the entire picture."

Parker paused, sipped from a glass of water and continued. "Several days ago I spent some time in an artists' colony." Inwardly, he grinned at several pairs of upraised eyebrows. He'd told no one the source of his idea.

"It was a nice place. Full of nice people. Happy people. However, only a few of them were actually artists. The rest spent their time on other things. For instance, one kid studied herbs."

"*Herbs?*" President Neely blurted in disbelief.

"Right. And a woman was looking for a common denominator between American Catholicism and UFOs. Another old duffer was trying to develop an infallible bait for Rocky Mountain trout."

"Trout? Trout?" Neely was looking definitely worried.

Parker smiled. "You see, all those ordinary people had an itch to know something, figure it out. And there they were, happily scratching.

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Gentlemen, what's *your* itch?"

Everybody looked puzzled. They were used to ideas from committees, from long reports, from scientists. Not from artists' colonies.

Parker pressed on. "Our main problem today comes from the idea that work is a physical endeavor, with a tangible product. But that's stupid. We could train chimps to do most of what we call work today. We don't, though, because machines are more efficient than chimps. Or men. And there we miss the point."

He glanced down the table, saw that he had everybody's attention. "The point is that people want meaningful work both in the intrinsic and the instrumental senses. They want to be doing something worthwhile that produces a valuable product. And most of them can't, because technology can do it better. What's left, then?"

Out of the corner of his eye, Parker saw Stan Nottingwell nod gravely. Neely, on the other hand, was obviously baffled.

"What's left is new products, gentlemen. *Ideas!* And ideas are produced from mental, not physical, labor. Do you see?"

Chubby Cabot's round face was wrinkled in thought, as if he was trying to figure out how much to charge for an idea.

"Machines can't think creatively. But *we* can. In fact, we do it better than anything else. The OCD will encourage this. For the first time, the weight of government, of private industry, will go into the creative reservoir of the nation. Picture it! Anyone—and I mean anyone—who wants to research or develop an idea will have the means to do so. The grazing habits of the Plains Indian? OCD will provide history, weather patterns, campgrounds, transportation to original sites. The perfect golf swing?" Parker grinned slyly at President Neely. "OCD will give you computer time. Measuring instruments. Statistical analysis. OCD will train you. In fact, OCD will be whatever you need to explore the treasury of your own mind."

Parker paused to catch his breath. He thought he had them. And though he'd discussed various problems already, he wanted to put a capper on the feasibility of the whole idea. "Gentlemen, I've already run a short pilot program in Denver. The results are sketchy, but meaningful. It seems that most problems can be handled. And, with proper public relations, we can expect a sizable percentage of the population to participate in the new program!"

Parker placed his hands flat on the table and leaned forward. "There will always be problems, gentlemen. But we can work them out, if we decide to do so. People laughed when we wanted to go to the moon. Should *we* laugh at opening the vistas of man's mind to him?"

Parker looked expectantly around the table, but he was calm. He knew he had convinced them.

"I can't believe that nobody's laughing!"

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The trained, oratorical voice of Marcus Paine sliced through the silence like a whip. His twisted face was bitter as he continued passionately. "Look at you. Grown men, talking about tossing billions into a boondoggle like this! Well, if you think two million auto workers caused a problem in this town, wait till you see ten million members of the People's Lobby--"

As Paine raved on, Parker saw doubt, apprehension, then fear cloud the faces of the men around the table. He knew they were suddenly considering the problem of defending his idea before a national attack from Marcus Paine, and they weren't liking what they saw. He knew it was time for a last roll of the dice.

"Mr. Paine!" he cut in sharply.

"And—uh, what, Parker?"

"We seem to have an impasse. Let's you and I discuss it in private."

The smile that flickered and disappeared on Paine's face told Parker that he'd made the right move. Paine wanted to negotiate.

The group rose, broke into pairs and trios of muttering men. Parker escorted Paine to the door which led to his own office. Mike Peters was waiting there. Parker glanced at him as they went past.

"On my desk?" he whispered to the chief aide.

Peters nodded.

The office was very quiet. Parker went to his desk and sat, motioning Paine to a chair. "Okay, Marc, what do you want?" he asked calmly.

Paine carefully arranged his immaculately tailored frame. "I told you once before, Bobby. I want Neely's job. But if this OCD thing goes over, whoever heads it up will be more powerful than that idiot golfer ever dreamed of being. So that's what I want. The head of your new agency. That's my price."

"Your price for what, exactly?"

"For my help. I'm not a fool. The weak link in your whole plan is having to sell it to the public. And if I oppose it, create a controversy, you don't stand a chance. On the other hand, if I back it, with the People's Lobby behind me, then its prospects are excellent. So that's my offer. I head the new agency, or there won't be one. Well. What is your answer?"

For a moment Parker considered the idea. But no, Paine would subvert the idea, turn it into a tool for his boundless ambition. Either way, he would destroy the OCD.

Finally, Parker said, "No, Marc. I can't do it that way."

Paine's face froze. "Then kiss it good-by, Bob. Kiss it good-by."

"No, wait a minute. Read this, before you make up your mind." Parker handed the man an envelope. "It's something one of my aides put together."

Paine opened the envelope, took out some papers and photographs, and began to read. The more he read, the paler he got, until his face was bleached the color of bone. He spoke through clenched teeth. "This is blackmail, Parker."

"Yes. But quite effective, don't you

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think?" Parker agreed quietly.

Paine tossed the envelope back. "And what do *you* want?" he asked.

"Your support, of course. I want you to handle the public relations campaign. You'll have a top-level agency position, but one where I can keep an eye on you. You understand? I admit you do have a genius for handling the public..."

Paine and Parker re-entered the conference room. They both wore strained smiles. "Gentlemen," Parker said tiredly, "I'm pleased to announce that Marc Paine will coordinate public relations for the Office of Creative Development. Thank you all very much."

The applause was relieved, but loud.

Marc Paine and Bob Parker were gazing through the observation level viewport of Satellite L5-OCD. In the starry distance one light flared brighter than the rest.

Paine sighed, "My God, Bobby, it's been a long time. Fifty years since you blackmailed me into this. If I'd known the problems—oh, the problems!—I'd have let you go ahead and use that stuff in your envelope. At least OCD generated a lot of answers itself. The life extenders, though—I thought they would sink us. Though without them I'd be dead and dust by now."

Parker grinned. "Yeah. Who could have guessed that a kid working in a Colorado OCD center would discover the anti-agathic series in a bunch of stringy mountain herbs?"

"Uh-huh. Or that an auto worker turned physicist would get together with Dr. Hannaford to formulate the Reunified Field Theory? Times change, Bobby, I'm going to retire from OCD. Running it these last few years has been fun, but the starships are going out. I'd like to be on one of them," Paine said.

Parker rattled the ice in his glass. The slow turning of the station sent the receding flare out of sight. "Me, too," he said. "I need some new problems to solve. It's been a long time since I've had to think for a living."

Starship Prometheus plunged inexhorably outward as the two men turned back to the bon voyage party.

The unemployment crisis was over. ■

DUE TO CIRCUMSTANCES BEYOND OUR CONTROL . . .

This particular bandwagon is one we never like to board, but from time to time inflation forces us. The costs of paper and production have again caught up with us, and with the April issue our newsstand price will, regrettably, go to $1.50. I'm sorry to have to tell you this, and we'll make every effort to hold at the new price level for as long as possible.

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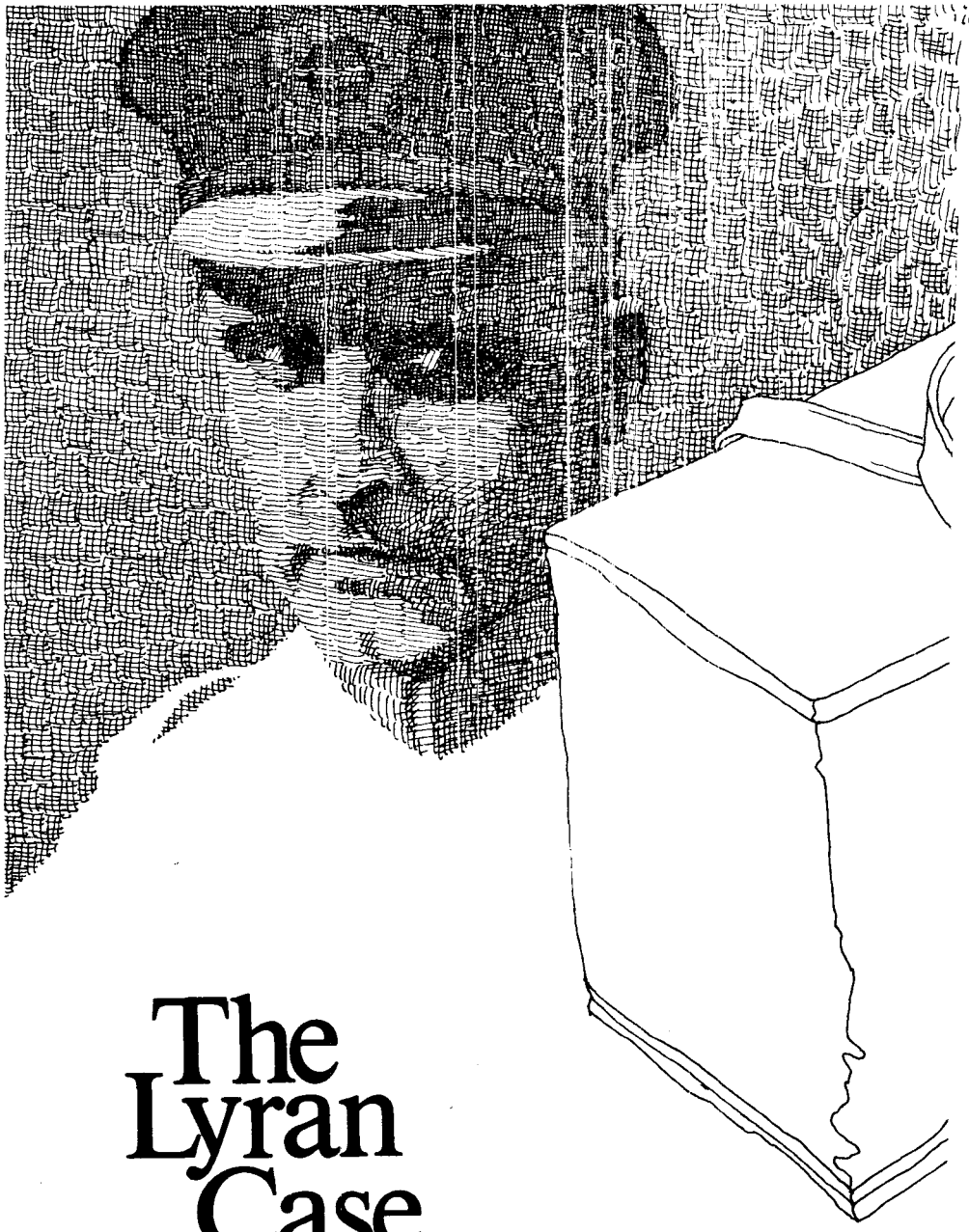

The Lyran Case

BILL PRONZINI and BARRY N. MALZBERG

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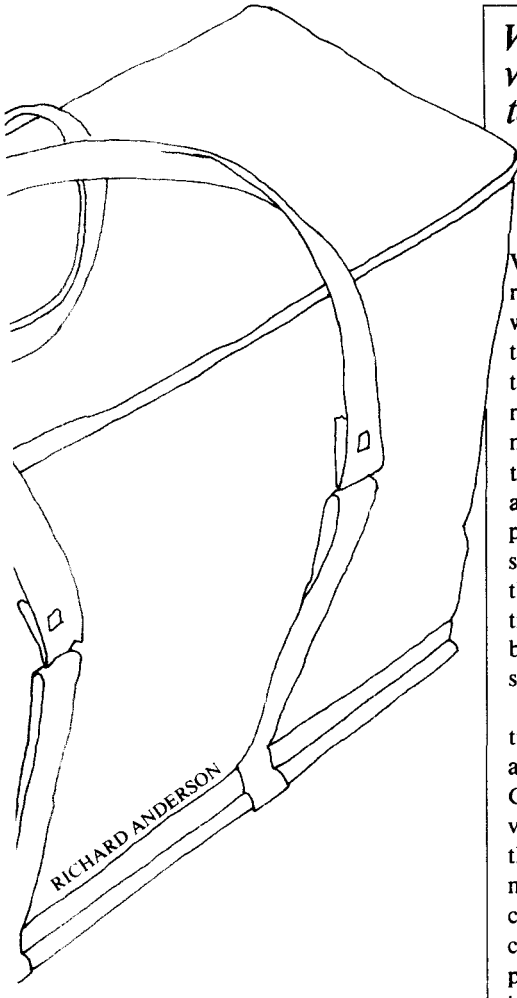

When you work with aliens, take nothing for granted.

What I would end up referring to in my report as The Lyran Case began when word reached us at Luna Immigration that a mad 2834-Lyran was suspected to be on his way to the Checkpoint carrying a bomb. The bomb, if he were to make passage, would subsequently be taken to Earth and detonated. Lyrans are supposed to be a hot-blooded, passionate race who take their politics seriously, and their recent entrance into the Federation had created an opposition faction on the home planet which believed in the loss of autonomy or some such.

I'm an Immigration Inspector; politics are arcane to me. Our job is to clear all visitors to Earth through the Luna Checkpoint and make sure that the obviously diseased or mad do not get through, with or without dangerous materials. On the other hand, politics can become a matter of relative urgency when it involves potential assassins, plague carriers or drug merchants passing through the Checkpoint and getting to Earth, and it means that we're in a mistake-proof business. Or at least we'd better be. Fortunately, though we've had a history of close calls, we have not as yet passed through any assassins, plagues or bizarre addictive

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drugs, at least in any condition to wreak havoc.

Still, every day is a new day, as they say in this business, and one without history.

I was on the number three inspection table when the tall red Lyran female with the valise came down the line. Nobody in our Sector knew much about Lyrans; they were a distant race on the edges of Federation territory and only a few had come through the Luna Checkpoint prior to their recent enrollment in the Federation. We had a gross physical description, of course —they were a distinctly humanoid race of reddish skin color—the usual metric and biological data; and we also had the interesting and ominous intelligence that the Lyrans were gifted in the art of disguise; their history as the only surviving intelligent race on a gaseous, malodorous and unfriendly planet had meant that they were peculiarly adaptable through a range of biological manifestations. The fact that this particular Lyran was markedly female put my senses on alert; we had been advised of the probability of a *male* Lyran transporting the bomb and it would not have been surprising for him to have adopted a female form as a means of misdirection.

I used the hidden standby nodule under the table to alert the guards but otherwise gave no indication. It was important to maintain a casual appearance; a fanatic under pressure might take the Checkpoint itself as the time or place to set off the bomb if badly frightened. The idea was to handle the matter within context and I did that, processing through the vast shuffling line of Terrans and Martians and elongated creatures from Sigma Draconis and hardy Titanian tripeds in humanoid suits and diffuse Beta Hydran methane rollers in their multicolored protective gear. One is exposed to all the jewels and facets of the galaxies on the Luna Checkpoint, which is one of the reasons why I like it; all of the Federation creatures are a celebration of the mystic range of creation. One becomes metaphysical in this business or one does not survive at all.

The female Lyran paused before me and looked at me with her translucent, penetrating and sensitive eyes as she set the large beaded valise on the table. With her other hand she gave me credentials—matching photograph, vitae-sheet, identifying genotype—all of which appeared to be in order. The papers were cool from her touch, and the skin of her hand almost cold when I gave them back.

"Please open your valise," I said.

The Lyran stared at me for several seconds. Then she said in unaccented, precise Federation English, "Is that absolutely necessary?"

"I'm afraid it is. Regulations."

"Won't you just stamp my passport and pass me through?"

"Not until I examine the contents of your valise," I said.

"I resent this invasion of my privacy."

"Then you're free to return to your point of origin."

She hesitated for half a dozen

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seconds, seemed to shrug, and then unlocked the valise and lifted the lid. I turned it around on the table, watching the Lyran's expression as I did so. She appeared bored—and normal and female in all respects. But my instincts, which are highly developed after twelve years of service at Luna Immigration, said otherwise.

This was the Lyran we wanted, all right.

The valise had a warm, damp, alien feel; I let go of it and bent over to peer and poke around inside. All it contained were several hundred small illuminated holographs of Lyrans in what can only be described as compromising positions. In other words, Lyran pornography.

"Sorry," I said, "I'll have to confiscate this material."

The Lyran looked at me stoically.

"Pornographic materials of all races are banned on Earth," I said. "We don't legislate the morality or pursuits of any race, but we can't permit Earth as a place of access to goods or activities which might be misinterpreted by home governments. I'm sure that you will understand."

"I resent this invasion of my privacy," the Lyran said. "I will complain to my government."

"That's your privilege. Would you rather return to your point of origin at this time?"

"I have business on Earth."

"Such as the selling of Lyran pornography?"

"I have business on Earth," she repeated.

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"Then you'll have to leave the valise."

"Will you stamp my passport and pass me through?"

"No," I said, and stepped down hard on the Emergency nodule. In less than ten seconds, the guards who had been waiting on standby alert converged on us and seized the Lyran female. They began to drag her away toward the Detention and Interrogation cubicles.

"No," I said quickly, "no, no, you don't understand! Take her to the Bomb Defusion Squad at once!"

The guards hesitated, looking at me in surprise.

"The Lyrans are masters of disguise," I said, "they're shape-changers. What you think is the Lyran is the *bomb*. The real Lyran is—"

The valise began to shake on the table; then, suddenly, it sprouted legs, lept off to the floor, and began to scuttle away at top speed.

"*That's* the real Lyran!" I shouted at the guards. "The Lyran is the valise—arrest that valise!"

One of the guards dragged the bomb away; the others pursued the valise as it frantically scuttled through the clearing area. But it didn't have a chance. The first of the guards drew his stun-gun and shot the valise in the left buckle. It rolled over on its back, little red legs pumping in the air, and lay there quivering.

And that was the end of The Lyran Case...

"It was misdirection," I said to the Supervisor later. "We expected the Lyran bomber to show up in disguise, but masked as another Lyran; and we expected the bomb to be well-hidden, but still a bomb. It was a clever idea. He assumes the shape of an inanimate object and rigs the explosive device as a Mechanical—a communicating Lyran with a carefully programmed pattern of response. The pornography was included so that the valise—the real Lyran—*would* be confiscated and remain safely on Luna while the bomb—the false female Lyran—would be cleared through Checkpoint and eventually explode when it reached Earth."

The Supervisor nodded. "So how did you ever manage to put the picture together?"

I gave him a self-effacing shrug, the kind he liked and the kind that would guarantee my promotion to the executive level one of these days. "Three things," I said. "First, a feeling that something was wrong with that particular Lyran lady. Second, her limited dialogue responses—the same or same sort of comments and questions, just like a Mechanical."

"And the third thing?"

"The female Lyran—the bomb—was cold," I said. "But Lyrans, a survivor race on a brutal world, are supposed to be a hot-blooded passionate people. That description fit the valise a lot better than it fit the female."

"Fit the valise?"

"It was warm and damp," I said.

"You don't mean—?"

"That's right," I said. "Nervous sweat."■

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Riposte to Pournelle

THE ALTERNATE VIEW BY G. HARRY STINE

"With regard to large space projects, there are three things to do: one, get the money; two, get the right people on the job; and, three, get the wrong people off the job."

—Count Guido von Pirquet

It has taken many months, but I finally have an alternate view to that of my esteemed colleague, Dr. Pournelle. This difference of opinion does not mean that I respect him any the less, but it *was* the purpose of these alternating monthly columns to present different sides of a question when and where possible.

In the October 1979 issue, Jerry asks the legitimate question, "Shall We Save The World?"

My answer is "Yes. Of course. Who else will do it?"

But we *must* do it a different way than Jerry proposes: Asking the politicians for more money to put into the Space Shuttle program, etc., etc., etc.

I have heard this for twenty-five years. It worked once; it will not work again in the future.

We have come through the Great Aerospace-Political Era, and it is finished. Like the Beat The Russians Game, it can no longer be played.

The Great Aerospace-Political Era began on October 1, 1932 when Dr. Wernher von Braun went to work for the Waffenprüfamt of the German Wehrmacht. Von Braun and his colleagues at the Verein für Raumschiffahrt had convinced the German Army and therefore the German government to provide the funds and the facilities for their rocket research. This effort resulted in a ballistic rocket that could take ten times the payload of the legendary Paris Gun to twice the range with half the dispersion. It was called the *Aggregat Vier,* the A.4, or "Vergeltungswaffe Zwei," the V-2.

The A.4/V-2 was a major advance in rocketry but a lousy weapon. It was rushed into production before all the bugs were out of it. It had continual and significant cost overruns.

But the A.4/V-2 would take a payload of 1000 kilograms to an altitude of more than 200 kilometers if everything worked right, which was seldom. As such, it was the first space ship. Its first successful flight was October 3, 1942.

After World War II, Dr. von Braun came to the United States, bringing with him a large number of his colleagues from Peenemünde. In the ensuing quarter of a century, von Braun taught American aerospace marketing managers the most important thing he had learned: How to get on the government teat and get your hobby paid for by the national treasury.

And, oh, the Americans learned well! They may not always be first, but, by God, when they do get their

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arses in gear, they do it bigger, better, faster, and more expensively than anyone in the world! Why, even today, the British buy their jet fighter planes from the United States even though the British *loaned* us a model of their first jet engine to play with. And the Germans buy their rockets from us to launch their scientific satellites.

N.B.: I am *not* saying that what von Braun and his American aerospace acolytes did was wrong, incorrect, unethical, immoral, or improper. It worked. That is what is important.

But it doesn't work any more.

"I vas dere," friends, in the main control room and studios of CBS in New York City with Walter and Arthur and Wally during Apollo-11. I was one of the CBS science consultants. I saw the beginning of the end of the Great Aerospace-Political Era. People such as Dr. W. Walter Menninger, Kurt Vonnegut, Jr., Gloria Steinem, Ira Magaziner, and Dr. Ralph Abernathy began to ask embarrassing questions such as, "Who's making a buck out of this other than a bunch of guys who have been doing this as a favorite hobby all their professional lives? Where does the Man-In-The-Street come in? How do we make a buck out of it? As entertainment, once you've seen one moon landing, you've seen them all!" A lot of people saw their tax money being spent on somebody's pet project, and they wanted it spent on *their* pet project instead.

I think Wernher von Braun sensed this and also sensed that he had won the moon but couldn't win any further battles. I knew and respected von Braun, and I watched him slowly come apart in the years following Apollo-11. It was tragic.

But the Great Aerospace-Political Machine ground onward and upward, culminating in the purely political Apollo-Soyuz mission in 1975.

But it had peaked out in 1965.

Think not? Go back and look at the NASA budgets from 1958 to the present. Where is the peak, friends?

The Great Aerospace-Political Machine did not get the message when the Boeing SST was cancelled.

The Great Aerospace-Political Machine did not get the message when three of the Apollo lunar landings were cancelled.

And the Great Aerospace-Political Machine still has not gotten the message.

This is all clearly evident in the book, *Enterprise,* by Dr. Jerry Grey (William Morrow & Co., New York, 1979) which is an important contribution to the historical literature of astronautics and which should be in everyone's library if they are at all interested in getting the human race into space. It goes into great detail concerning the political compromises and infighting both in Washington and in the aerospace community concerning the NASA Space Shuttle. It is an important book because it tells us what *not* to do from now on! The same message comes out of such classics as W.R. Dornberger's *V-2,* Willy Ley's

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Rockets, Missiles and Men In Space, and nearly all of the NASA historical documents so carefully prepared and published by Dr. Eugene Emme who was NASA Historian during the golden years of the Apollo program. The message is also clear from the "Congressional Record" and from the volumes of congressional testimony on future space programs that have taken place since 1969.

The message is simple: "Get Star-Trak (the space-going Amtrak) off our tax-paying backs, get it in the hands of private industry, and make it pay a return on investment to us!"

"But nobody is going to take the risk and put up the capital," comes the cry from the aerospace types.

Nonsense! You guys in aerospace have got to learn *how* to sell space to American investors. Look at Boeing. Sure, they dumped a cool $16-million of their money in the Model 707, and they knew how to sell it to the USAF as the Model 717 tanker. Then they had to learn how to go out and sell it to the domestic and international airlines, the people who had to make a buck with that airplane. Boeing learned their lessons real well. It's damned hard to beat them in the airliner marketplace today.

In the opening of the American West, the government did not build the roads. And they sent in the troops only when citizens raised hell in Washington. The canal system of the early 1800's, the transcontinental railroad, the Panama Canal, and the early reclamation projects of the West were *not,* repeat *not,* built by the government. They were built by private enterprise operating with government guaranteed loans, government grants, and other government incentives. It has been only since 1932 that the government has been involved in such projects as Grand Coullee, TVA, and the space program.

But space transportation is claimed to be far too expensive and far too risky. It is claimed that it involves the highest technology, which is expensive. Look, high technology is not expensive, but crude and primitive technologies are until they become refined. Saying that high tech is expensive is admitting that you still don't know how to make it work economically, which means that it is still crude and primitive.

Earth-to-orbit technology has been with us for over twenty years now. Six nations have achieved orbital capability with their own indigenous launch vehicles. Three of these nations, having once done it on their own, are now buying American expendable launch vehicles because they are cheaper.

It is quite feasible today for a modest investment to build and operate a manned orbital space ship. OTRAG was on the right track trying to do it as a private enterprise venture until politics laid them low.

I have personally been down this road myself in a little different manner. In 1957, young people all over America were killing themselves trying to make their own rockets. Thanks to a shoe store owner in Norfolk,

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Nebraska, named Orville H. Carlisle, I stumbled upon the answer: a model rocket made with model airplane technology using a factory-loaded solid rocket motor made with pyrotechnic technology. It was a pure and simple private enterprise operation. I was told by the professionals at the American Rocket Society and with many of the aerospace industries that I contacted for help that it was totally impossible to safely put rockets into the hands of young people. It would be too expensive, too dangerous, and illegal to boot. Well, friends, twenty-three years later there have been more than 150-million model rockets flown in America without a serious injury. The model rocket industry grosses more than $10-million annually, and I became the chairman of the national committee that writes the model laws for explosives, fireworks, and model rockets. So don't hand *me* that aerospace propaganda about space transportation being too expensive, too risky, and too dangerous. It doesn't have to be if we follow von Pirquet's admonition.

Yes, we science fiction writers, readers, buffs, and fellow-travellers of the conquest of space *must* stick together and save the world by moving the human race into space.

But we can no longer expect to succeed in doing it by writing members of Congress, writing the White House, supplicating NASA, or trying to get the space budget increased.

What we must now do, as the L-5 Society and other groups are currently doing and as the AIAA is *not* doing, is to convince entrepeneurs that there is a big buck to be made out in space, that the costs are not outrageous, and that it is a way to get out from under EPA, OSHA, FTC, and all the rest of the Washington Alphabet Soup Bureaucracy.

Getting to the moon and keeping Skylab manned for months was only the first step. Time for Lewis and Clark to step aside now. Time for D. D. Harriman to take over.

And the best way we can bring that to pass *is* to write your senators and congressmen and urge their support of the Stevenson-Schmitt proposal and Don Fuqua's H.R.2337, the "Space Industrialization Act of 1979." What the government can and should do now, if it will follow historic precedent, is to step in with incentives for business and industry to get into space so that we can begin to decrease industrial pollution, decrease dependence upon terrestrial materials, and increase the availability of electric power. Right now American industry consumes 60 percent of the electric energy generated in the United States; we use only 30 percent for domestic and civic purposes. Move industry into space, and we *can* shut down the nukes!

If we are going to save the world, as we must, then we must also stop playing the old game and get involved in the new fracas: getting government *out* of space and getting private enterprise *into* space.

The Old Era in space is dead! Long live the New Era. Vive la revolution! ■

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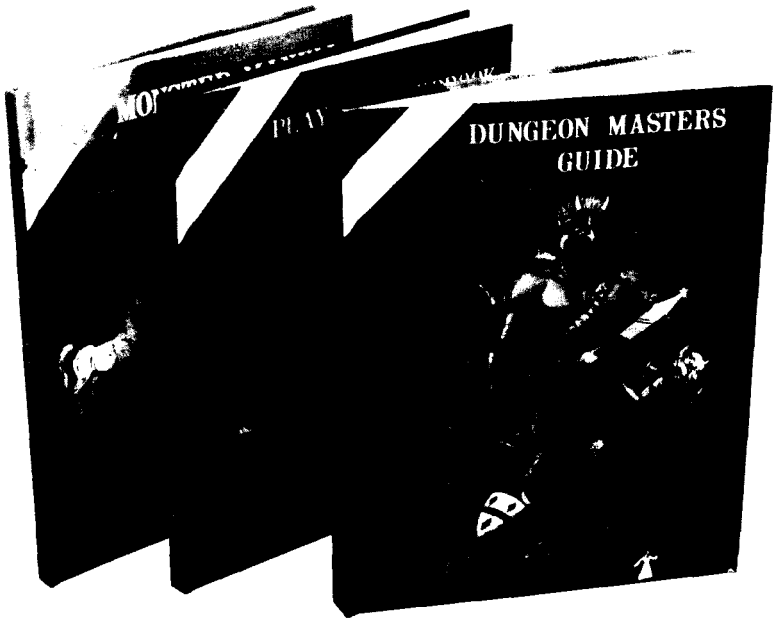
THE ULTIMATE



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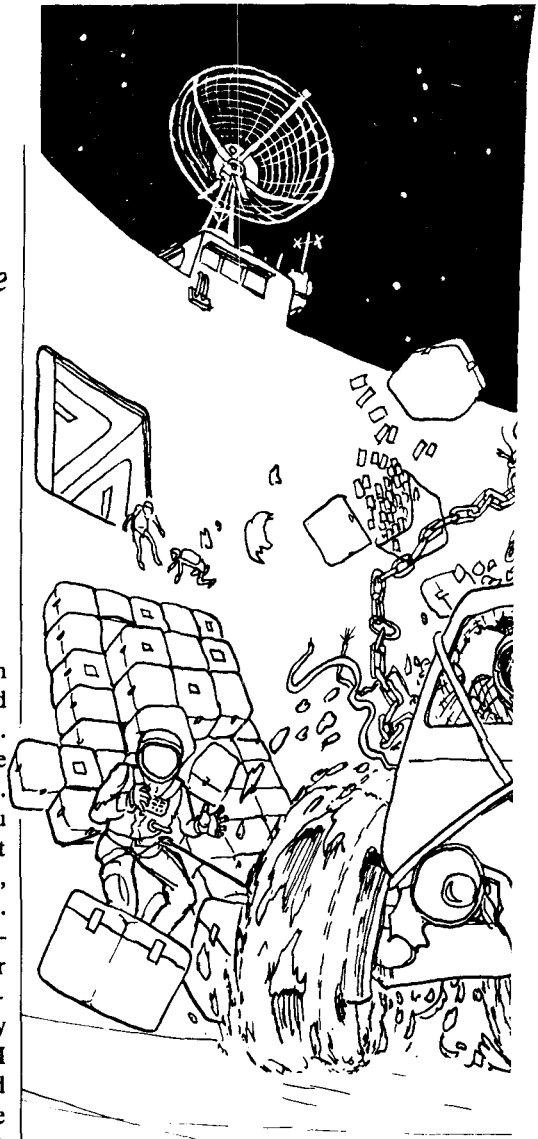
Detour

It's remotely conceivable that you'll find a wee bit of improbability in this. But every frontier generates tall tales!

RICK GAUGER



Naw, these buggies never break down on the trails. Well, almost never. And even then, you're not in any trouble. The whole moon is covered by satellite relay these days. Not like it used to be. Why, when I started driving, if you were below the horizon of the nearest settlement, and it was too far to walk, stranding was apt to be permanent. Someone coming along the trail a couple of weeks later would find your dried-out mummy. Ugh. Almost happened to me one time. Quite a story about how I got out of it. The buggy I was driving became famous. Wound up in a museum. I wish there were something on the radio besides that shit-kicking music.

Oh, it was several years ago, pretty soon after I settled down and became a ground vehicle jockey. Hah. I thought I wasn't going to be doing any more space piloting.

That buggy trip was unusual from the start. I was chauffeuring a few technicians from Grimaldi Main. The vehicle was similar to this one, four wheel electric drive, four seats, cargo space, and so on. The technicians were inspecting the mass-driver guidance units along the Grimaldi Catapult track.

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We were rolling along, three hundred clicks from the nearest civilization, within sight of the turn-around end of the catapult track when it happened. Without any preliminaries, there was a bang and a flash under the buggy, followed by an explosion that almost turned us over. I reacted instantly. I locked all four wheels and leaped out of my chair. I began to run around the cabin of the buggy holding my pants away from my crotch.

"What happened?" cried Compton, who was sitting in the front seat

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next to me, excited.

"What do you think?" I shouted back. "You spilled your coffee in my lap!" Steam was rising from my fly.

"No! Outside! What happened outside?" Gesturing violently, he rapped the backs of his fingers against the window next to his seat. "Ow!" he yelped, and stuck his knuckles in his mouth. Newbies from Earth have to be careful when flourishing their arms around because their muscles are too strong for our gravity here. You should keep that in mind until you get used to it.

Outside the buggy's windows, a cloud of white vapor was dissipating. My ears had already told me that the cabin was still holding air. That was lucky because we could've never gotten into our suits fast enough if it had been split. But, I tell you, what I saw on the dashboard gauges made me grope for my seat. The gauges apparently didn't have anything to gauge. The lox pressure needles were lying on their sides, and all the batteries registered dead as mackerels. Even the emergency battery was gone.

"Oh, brother," I muttered, stopping myself from reaching for the cabin light switch. We were several days into night time, and it was pretty gloomy. I had been driving by the light of the half-Earth and my highbeams. Outside, all around us, were the dim flats of the Oceanus Procellarum, whatever that means. Gray rocks, gray gravel, gray dust. As my eyes adjusted, I began to see the stars.

Both passengers were looking at me expectantly. With a great effort, I came up with my Cheerfully in Charge manner. "All right, then!" I said briskly.

The passengers nodded in unison.

"Let's all put on our vacuum suits quickly, and I'll step outside and look at the damage, I mean, the situation. It's almost time to stop for the night anyway, isn't it?"

Compton, a beefy young man fresh from Earth with a degree in programming, was watching me excitedly. "Can I come along, Captain Suarez? I'm a pretty good mechanic."

"Sure thing. Two heads are better than one, aren't they? Ahem."

The other passenger, who had been sitting in the back seat, rose to her feet. The buggy rocked on its springs. This was Mrs. Doctor Washington. She was as tall as you are, and big, about one-thirty kilos. She was an unlikely type of person to meet on the moon in those days. She was about sixty, I guess, and as soft and sweet as a freshly baked chocolate cake. She reminded me of my big, fat, wonderful abuelita back in Nogales. She had a lap made for a little boy to sit on. On the way up the catapult track, between stops at the guidance units, she had talked about her grandchildren and her husband, whom she called "the Mister." Flashing a gold tooth, she had gone on about how she had "gotten out of the house" and "finished school" when her kids had grown up. I had liked her immediately, but I don't think she fitted Compton's ideas about whom he would be working with, off-Earth.

On the other hand, there was nothing grandmotherly about the suit she wore

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when she and Compton were outside working on the guidance units. It was a custom-made, fully-articulated Grumman hard suit that would have cost me a year's pay. I got the idea she had come to the high frontier to stay. Of course, she might've had the hard suit built around her because she had a shape like Aunt Jemima. She obviously wasn't able to squeeze into any of the standard ready-made sizes.

I took Compton outside with me, leaving Mrs. Washington nodding benignly at us from the open hatch of the buggy. Together, we went around to the opposite side of the buggy. I didn't say anything when I saw the ragged hole blasted out of the side of the gas bottle compartment. On hands and knees, we crawled under the buggy.

One wave of the flashlight confirmed the worst. A carbide steel rock drill bit had jumped out of the lunar soil and opened up the bottom of our buggy like a church key going through a beer can. All the batteries were gouged to pieces and all the wiring was ripped out. The circuit breaker panel was lying, melted into a lump, between the rear tires. The lox bottles had gotten overheated in the short-out. They had blown up, taking the water tank and the radiotelephone out through the side of the compartment.

We were lucky we hadn't been incinerated. I guess the drill bit had been left behind by one of the construction crews. Later, it had been buried by a passing heavy hauler, just so it could pop up now and do a number on us.

Reaching over, I plugged my suit phone cord into Compton's helmet and flipped off his suit radio.

"Why'd you do that?" he asked.

"I don't want Mrs. Washington to overhear us on her suit radio. This is damn serious."

"Oh. Right," he said. "It's a mess, all right."

"It's worse. This buggy isn't going another centimeter under its own power. It needs a complete rebuild."

"Right," he said knowingly. "Let's get started. What should I do first?"

"What I mean is, we can't fix it. It's hopeless."

"Well, at least you'll get some rest while we're waiting to be picked up. You've driven a long time. I'll monitor the suit radios while you're asleep."

I just wasn't getting through to him. He was having an adventure. It was what he had come into space for. I hated to break the news to him.

"We're not going to get picked up. We're stuck."

He peered at me through my helmet visor. He said, "Huh?"

"We're stuck," I told him. "This is it. We're done for." I thought those type euphemisms would appeal to him the most.

"C-can't we call for help?"

"No. All we have are suit radios. We're out of line of sight with Grimaldi Main or anywhere else. About all we can do is try to raise Earth or some spacecraft, but the chances of that are practically zilch. The radios aren't designed for it; wrong freaks, too weak."

"What about when we fail to return to Grimaldi? Won't someone come

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looking for us?"

"I'm afraid not. This was an unusually long trip. We aren't due back for another thirty hours. Our supplies can't last that long."

"But . . ."

"Backpacks are all we've got, amigo. About fifteen hours. I'm sorry."

"But. . ." He knelt there with me in the dimness under the buggy. He looked back the way we'd come, then ahead. He was realizing that the nearest hot shower, cold beer, and fresh air were three hundred long ones away from where we were. I pulled out the phone plug so I couldn't hear him any more. I don't mean to sound tough. I'm not a tough guy. But, you know, I would've sympathized with him more if I had been back in my apartment watching it all on T.V.

I switched my radio on again and pulled him out from under the buggy. Then I heard Mrs. Washington's voice in my earphones: "Captain Suarez?"

"Ma'am?"

"I appreciate your trying to protect me from the harshness of life, but, in the future, you will keep me informed of all developments in our situation. If we are to survive, we're going to have to use all our intellectual resources. You get me?"

It occurred to me that she didn't sound so grandmotherly any more. "Yes, Mrs. Washington. How—"

"Doctor Washington. Your helmet pressed against the frame of the vehicle while you were talking to Mr. Compton."

"Oh. Heh-heh." I pushed Compton ahead of me back to the buggy hatch and helped him in. Climbing in myself, I sealed it up and repressurized the cabin. The air left in the buggy's regulator system gave us a few hours before we had to go to the suit backpacks.

As soon as Compton got his helmet off, he suggested that he try to make it back to Grimaldi Main on foot. "I couldn't get lost," he said. "All I have to do is follow the catapult track. When I get there, I'll have them send a rocket hopper. I'm in pretty good shape. I bet I could make it."

I could see that he was visualizing himself heroically leading the rescue party. "No, Compton, that's out. You'd have to average twenty or thirty clicks an hour to get there before your backpack gave out. That suit of yours couldn't stand up to it anyway." He was wearing an inexpensive survival suit that looked like a stack of inner tubes.

"Our best chance is to stay put, conserve air, and hope somebody comes along," I told him. "Why don't you raise someone on your suit radio? Hook it to the buggy antenna. You might get a spacecraft, or Earth, maybe." At least he would keep busy.

I thought I should say something to Washington, but she had turned away. She was busy pulling books and paper out of the equipment they had piled in the back of the buggy. Probably wanted to compose a last letter to her family, I thought.

As terrifying as the situation was, I was having trouble keeping my eyelids apart. Since that morning, I had driven the entire length of the catapult track, with stops every twenty clicks to let the

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passengers work on the guidance units. I had been behind the wheel twelve hours. We were due for a ten-hour rest stop when the accident happened. Nuts. I had my mind made up to get some sleep, if I could. I hoped I would dream about sex.

I dropped into the driver's seat and put on my headphones. I turned up some nice FM white noise from my suit radio and sat staring out of the front windshield of the buggy. We had come to grief very close to the west end of the catapult track. I could see the circular turn-around loop for the catapult buckets a few hundred meters away. As you know, the Grimaldi Catapult only has a single track, with turn-around loops at each end. The track runs parallel to the lunar equator, which is only a few clicks away, as if anybody gave a damn. The eastern, or launching, end of the track is in the middle of Grimaldi Main Base, which was at that time the biggest city on the moon. But the western end, where we were, that was a different proposition. The western end was in the middle of the biggest nowhere on the moon.

As my eyelids drooped, several launching buckets came down the track, looking like giant bookends on the loose. Each bucket was loaded with what looked like a stack of chrome-plated sewer pipes. Each bucket slowed, passed through the turn-around, paused, then moved off smoothly back east, toward Grimaldi Main. By the time the buckets arrived at the other end of the track, they'd be doing over two and a third kilometers per second. The buckets are slowed down violently, but the cargo slides off and keeps going, all the way to Zion Orbital Habitat at L4, three hundred and eighty kiloclicks up and out. The empty buckets are reloaded at Grimaldi Main and sent back to the west end turn-around to do it all over again. As a form.of space travel, it's cheaper than dope and twice as reliable. But it's slow. This is because the cargos slow down as they climb out of the moon's gravity well. By the time they get to L4 they're barely creeping, because they've used up the kinetic energy they got from the catapult. The trip takes a month, I believe.

I was working up a good fantasy about a girl I used to know when I felt an iron finger poking me in the shoulder. I sighed and took off the earphones. I might have know the passengers wouldn't let me sleep. It was the lady doctor.

"Captain Suarez," she said, "why don't we ride one of those catapult buckets back to Grimaldi? We could get on one of them while it's moving through that circle thing." She pointed at the turn-around.

I knew one of the passengers would think of this, and I had the answer all ready. "Because they decelerate at the other end at about eighty gees," I said. "We'd never live through it, even if we could figure out a way to stay attached to the bucket. Hell, you should know that, since you've been working on the thing." I should watch my mouth. No sooner had I got the earphones on again, she jerked them off my head.

"Owch, dammit! You're cauliflow-

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ering my ears! Quit that!"

"Stuff your ears!" she roared, all her grandmotherly blandness long gone. "You want to live, you wake up and listen! Those are rocket boosters on those buckets, right?"

I took another look. "Yes, ma'am, they're loxaluminum throwaway booster units," I said hoping to snow her with the technical verbiage. "Burn time, five minutes; total impulse, four kilogram-seconds." It didn't work. She went on relentlessly, looming over me as I sprawled in the driver's seat.

"That's what I thought. We're going to load this buggy on one of those buckets. Shut up! We're going to use one of the rocket boosters to slow us to a reasonable velocity before we get to the launching end of the track. Now off your ass and on your feet!"

This last was bellowed in my ear as a meaty brown hand grabbed me by the vac-suit collar ring and hauled me out of my chair. Before she jammed my helmet over my head, I saw that she had been doing some figuring. Papers were scattered around the back of the cabin, and a portable computer was winking red lights at me from her seat where she'd left it. Compton, who was quicker on the uptake than I, was hurriedly screwing on his helmet.

Within minutes, the three of us were outside, pushing the buggy, while Washington angrily lashed us on: "Ready, heave! Put your backsides into it! Grunt, Suarez!" I had gotten on her bad side, you see. She even made me hammer out the buggy window on the driver's side so I could steer and push at the same time.

The buckets had all departed by the time we got the vehicle to the embankment overlooking the turn-around circle. "All right," Washington roared, "Suarez, you start pulling wire out of the guts of the buggy. Compton, fetch the tool box!"

He just stood there looking at her, so she snatched the front of his harness and banged him up against her armored bosom. Presenting a gauntleted fist, she growled, "Now, I don't ordinarily hold with striking children—"

"No, wait, Mrs. Washington!" I cried, just in time to save him from being prematurely destroyed.

"He hasn't got his suit radio on," I explained. She glared at me as I switched on his radio.

"That's *Doctor* Washington," she said.

"Yes ma'am."

After that, we worked hurriedly, trying to get ready before the next set of buckets showed up. I pieced together electric wire to make a circuit from the buggy cabin to one of the boosters. Washington and Compton got out the tow chains and clamped them to the tiedown points on the buggy.

Washington's idea sounded all right, in an academic sort of way. Igniting a booster wouldn't be difficult. Detonators were stored in boxes welded to the side of each booster. We could set one or more of them off easily enough, using the batteries from our flashlights. What bothered me was the memory of the buckets we had seen as we had driven along the track.

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They whipped by so fast, if you blinked, you didn't see them. We were going to ride on *that*?

I heard Compton on the radio: "Gosh, Mrs. Washington, what if the next group of buckets is loaded with aluminum ingots or something else we can't use? Doctor Washington, I mean."

"Thank you, son. That's astrodynamics, M.I.T. I'm proud of it."

"Yes, ma'am. What about the buckets, though?"

"The Lord will provide what He sees fit to provide."

While we were waiting for the Lord to come through, Washington lectured us on our duties: "I notice that the last bucket in each set waits in the turn-around circle about two and a half minutes, so we've got no time for messing around. Suarez will wire up one of the forward-pointing boosters, and Compton and I will chain the buggy onto the bucket. I hope you all got that, because here they come!"

A new parade of buckets wafted into the turn-around. The last one in line, which was loaded with six boosters bolted together in two layers, came to a halt under the embankment just a little way from where we were waiting. Washington shouted "Go!" and the three of us rolled the buggy directly over the bucket, jolted it around on its springs to face the edge of the embankment, and pushed it off. We leaped down after it and had it facing forward on the boosters before it stopped bouncing from its fall. I got a detonator out of the nearest container, stepped to the nozzle of the middle booster in the lower layer, screwed it in, and wired it. There was a traffic jam at the buggy's hatch as we all three tried to get in at once. In spite of this, we were all inside, strapped down, by the time the catapult bucket slid smoothly out of the turn-around.

As the bucket gathered speed, I felt like I was being tilted over backward in my seat harness. The bucket accelerated at about one gee, and the buggy was facing the direction of travel. I could hear everyone panting in my earphones. Between puffs, Washington said, "Get the battery ready, Suarez. Ninety-five seconds to ignition."

My head was already pounding from being upside-down. I fumbled with the battery and wires. The view out the front windows was hypnotic. The catapult track was in an excavation about three meters deep. The ground surface was about level with the buggy's windows, and the sensation of speed was fantastic. As we accumulated velocity, I could no longer see the rocks and other details on the ground. It was like hovering over a smooth gray floor made of perfectly finished plaster. Now and then a large boulder or crater would pop into view on the horizon, suddenly inflate, and shoot by, all in the same instant. The bucket, which was floating on supercooled electromagnets, and propelled by linear electric motors was totally without vibration. With the catapult tracks converging on the horizon, the scene before us became a creepy sur-

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realist piece of art.

Washington was holding her wristwatch up in front of her helmet visor. "I'll start counting at minus twenty. Okay. Twenty, nineteen..."

I forced myself to concentrate. I had the flashlight battery and one wire in my left hand, the other wire in my right. All I had to do was touch the wire to the battery, and the rocket booster and Washington's calculations would do the rest. I knew, from my space piloting experience, that the booster would take three seconds to start burning, so I touched the wire to the battery at minus four. I was flabbergasted when nothing happened. At minus two I was frantically rubbing the wire on the battery terminal. At minus one I was trying to squeeze electricity out of the battery. At zero, I was bouncing in my seat, gibbering, "Ignite! Ignite! Ignite!" Washington stared at me, horror on her broad face. Horror and outrage. How could she be mad at me while we were hurtling down the track like that? Whose fault was it anyway, I'd like to know?

"Stop fooling with that battery," she yelled. "It's too late! Our only chance is to get launched along with the boosters and hope a spacecraft can pick us up."

"We'll be ripped to shreds when the bucket stops at the end of the track," I wailed, still trying to start the booster.

She reached across and knocked the battery out of my hands. "It's okay," she told me. "Compton and I couldn't make the chains attach to the bucket, they weren't long enough. We hooked them to the boosters instead."

Golly, wasn't that reassuring? Instead of being ground into hamburger, we were going to be shot off into the wild black yonder in a broken-down moon buggy at better than two thousand meters per second.

"Why couldn't we have just stayed where we were, and quietly suffocated?" I moaned, flinching every time something zipped by outside.

Washington ignored me and started fiddling with her suit radio. "Got to tell them we're on the catapult," she said. "Otherwise, they won't know to come get us, out there."

"Hell, you won't be able to blurt out the message before we're out of range," I said. "Besides, they won't have a spacecraft ready to go."

"You got a better idea, you just trot it out," Washington growled.

Then Compton in the back seat spoke up. "No sweat about the message everybody," he said. "I've written a note! I'll just toss it out as we go by the terminal."

"No! Stop!" Washington and I chorused. We struggled to twist around in our seats, trying to stop him, but we weren't fast enough. He had worked himself upright in his seat, and had pushed a sheet of Washington's notebook paper around the edge of the hatch nearest himself.

"I hope you didn't kill anybody with that paper, you dummy!" Washington bellowed at him. Then they both said, "Oolp!"

With stomach-wrenching suddenness, we had gone into zero-gee. The

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huddled buildings of the Grimaldi Catapult Terminal appeared on the horizon and flashed by. The cargo of boosters, with us attached, soared up and out, over the lunar flatlands.

"We've been launched," I groaned. Everyone was temporarily stunned into silence. I noticed a loose wire floating in front of the windshield. It was the end of my useless ignition wire. One of my twisted-together connections had come undone in the stress of the catapult launching.

"Captain Suarez?" said Compton plaintively.

"Don't worry about the paper, son. Just try to enjoy the ride." We were getting a beautiful view of Kepler on our left.

I heard later that Compton's note had slammed into the masonry wall of the catapult dispatch tower with a boom that was heard all over the station. Everyone thought the explosives dump had blown up. The staff had to go around in vacuum suits all day while the engineers looked for the cause of the noise. Old Tamara, the Chief of Ops, didn't show up for the regular Tuesday staff meeting. He was found locked in his office decompression refuge with his pretty secretary. I wish I'd been there to see that.

I didn't chew out poor Compton, but Washington did, a little. I felt that what he had done would enhance the mystery surrounding our disappearance from the moon. No one would know anything for at least a month. Then our buggy would drift into the hard-docking target at Zion,

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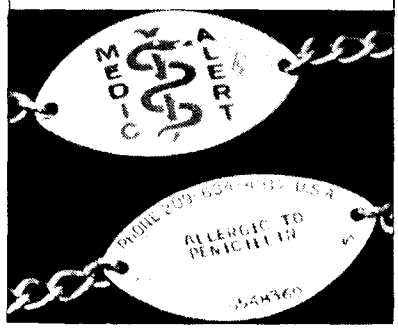

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with our dead bodies inside. My mummified face would smile hello! at the dumbfounded target crew, like a prune with teeth. I got some perverse pleasure from this thought. If you can't live to be an old fart, at least you can die like a young one.

I always say that, but I never wanted to put it into practice. As I sat there in the buggy, the lunar landscape flowed under us like a river of sludge, with craters for bubbles: Copernicus, Reinhold, Bode, and endless others. I could see us getting higher and higher above the surface. There had to be some way to salvage this mess, I thought. After all, we were riding in what amounted to a space ship. We had engines, fuel, life support, and a successful launch. We even had Mrs. Doctor Washington, astrodynamicist, et cetera. I'll bet you've already figured it out. I turned to face Washington, and found that she had turned to face me.

"Are you thinking what I'm thinking?" I asked her.

"Yeh."

"There are difficulties."

"Yeh. Such as, how we can aim the boosters correctly before firing them off," she said.

"That's not the problem. Each of the boosters is equipped with optical sights. The sights are for bore-sighting the boosters so they'll line up properly with the attitude control systems of the spacecraft they're used on. The difficulty I was talking about is how to know where to aim in the first place. And when to fire."

She exhaled gustily. "Whoo! We still got a chance! I have everything we need to try it: ephemeris, sky charts, programs for the computer."

I was too tired to be anything but skeptical. "What are we going to use for attitude control, good intentions?" My mouth, again.

"I expect you'll find the answer when it's needed," she said sternly, turning to her reference books and computer.

As you might expect, she was right about me finding the answer. Fear was the motivation. Fear of turning into the Flying Mexican. Fear of being beaten up by an angry grandma. I had the solution by the time she was finished with her calculations. We would modify our flying attitude by climbing around on the outside of the buggy-boosters lashup. Enough circumambulations by my heavyweight passengers, and the whole heap would start rotating in the opposite direction.

"Compton, I'm going to teach you how to be a zero-gee spacehand. It'll be good for your career."

He jumped up enthusiastically, clanging the top of his helmet against the cabin overhead.

"We'll use *two* safety lines for you," I added.

The rest you have no doubt guessed already. Compton and I wrapped the lines all over the buggy and the boosters. As the moon whirled under the buggy, I squinted through the sights of one of the boosters, giving directions to the other two as they clambered around and around. Don't

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ask me what I would've done if one of them had missed a handhold and gone adrift. We got the booster properly aimed in about two hours. Our first burn was a little rough, over two gees. I was concerned about Washington in her hard suit, but she said, "Don't worry about me. I got plenty of natural padding. You just get me back to my grandchildren and the Mister." Afterwards, we all got a night's sleep. She calculated that we could get seven hours rest before we had to start working on the deceleration burn.

I woke up feeling better, but the work required to get another booster aimed right for the deceleration burn was horrendous. Washington and Compton climbed around and around endlessly, while I played astronomer. After the burn, which was just as rough as the first one, we all had to get out again and cast off. I wired one more detonator, then we unchained the buggy from the six boosters, carefully pushing them away.

"Easy does it," I told Compton and Washington. "We don't want the buggy to start tumbling."

The cluster of boosters moved slowly away, or, I should say, we moved away from them, since the boosters were more massive than the buggy. The four unused ones gleamed splendidly in the sunshine. The two burnt-out boosters were dull, with patches of iridescent purple here and there. When the cluster drifted to the end of the ignition wire I was holding in my hand, I said, "Close your eyes, everyone," and touched the wire to the battery. The dazzling light of aluminum dust burning in pure oxygen made even my closed eyes water, which is annoying in a vacuum helmet. After a few seconds, we were able to watch the flame dwindling among the stars.

There was nothing else to do. We clung to the buggy, the three of us, while I searched the sky. The moon and the Earth were far away from us now, hanging against the black nothingness like an illustration for an article about cantaloupe blight.

"Are we making any progress?" Compton asked me.

"I haven't got the foggiest. I was hoping we would be within eyeball distance of Zion by now." There was nothing moving among the stars.

We were a pitiful sight. Our buggy with its wheels drooping under it, hung in empty space. The hatch cover had been ripped off its hinges and thrown away. Half of the windows had been broken out to provide attachment points for safety lines. The blasted-out hole near the rear was positively obscene. Ropes, chains, and wire floated all around the vehicle.

"Captain Suarez? I think I can see the space colony," said Compton. He pointed from his perch on top of the buggy's cabin. "See? Right there next to that bright star."

I could make it out, too. A tiny white dot grew larger as I watched. We had gotten a lot closer than I ever would have believed possible. I would've thought we were lucky to get within radar range, much less eyeball

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distance to the colony.

"That's not the orbital habitat itself," I said. "That's the colony's hard-docking target. Your figuring was right on the gnat's ass, Mrs. Washington."

"Doctor Washington. They must've seen that last booster's flame. How long will it take them to send out a spacecraft to pick us up?"

"Surely no more than an hour. They're probably inspecting us through a telescope right now. Wave, everybody!" Everybody waved.

"Yoo hoo! We're over here," I muttered to myself. The air in my vacuum suit was getting downright mousey. Hot, too, from sitting in the sunlight. I yawned, popped open my sinuses and eustachian tubes, and bled a little air pressure out into space through my helmet regulator valve. Now I was too chilly.

While the others waved, I studied the Zion hard-docking target. It had grown from a dot to a small white disk with a fluorescent orange bullseye painted on it. There was a red spark on one edge, probably a commo laser beam aimed at us. I didn't like the speedy way we were coming up on it.

"We better get inside and strap down," I said, feeling uneasy. We could watch from inside, since the front of the buggy was pointed right at the target.

Inside, Compton said, "They must be trying to call us on the radio, but I can't hear anything."

"They're using ship-to-ship frequencies," I answered. "They don't know we've lost our radio. They don't even know we're coming. We haven't even been missed yet, on the moon. Keep trying to get someone's attention. If they have a crew outside working, you might be able to get through to one of them on the suit radio frequencies."

"What's the diameter of that thing?" asked Washington. She was holding her portable computer between her knees, punching buttons with both hands.

"About three hundred meters."

"That's what I was afraid of. We're closing on it at about twenty-five meters a second. Looks like we're going to hit it, too."

I was afraid she was right. The hard-docking target was growing rapidly as we coasted toward it. It had become a hemispherical bell, yawning at us like an open mouth. The shadowy interior was speckled with lights. I could see miniscule human figures scuttling around inside. Our trajectory wasn't exactly in line with the target's axis, but it was obvious we weren't going to clear its edge. Close, but not quite. I couldn't believe it. How could anyone believe it? Blundering around in the lunar orbit, blind, guesstimating, we had managed to *hit* the damn thing. Jesus Christ, I was going to be the first man to die in a collision between an automobile and a space station.

"We've done the best we could do, Captain Suarez," said Washington. "We've all done our best. I want to say—"

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"I've got them!" shouted Compton, making my ears ring, "I've got one of the cargo handlers! He wants to know who the hell we are!"

The metal walls of the hard-docking target engulfed us. It was too late for anything. My body had jammed itself back in the seat, my lungs were inflated all the way, my brain was trying to scamper up a tree. The rim of the target swooped under the buggy's wheels. But we weren't dead yet. Some elusive idea flittered around my head. A fugitive thought that I couldn't quite grasp—

I had it. "Tell him we're tourists," I snarled at Compton. I grabbed the steering wheel. "Tell him we're looking for a place to dump the holding tank of our john."

We were going to be all right. All I had to do was step on the brakes.

What do you mean, is that a joke? Would I joke about anything so serious? The hard-docking target is shaped like a cup. The open end is kept facing the direction of approach of cargoes launched from Grimaldi Catapult. Our trajectory was almost parallel with the target's axis. The buggy's tires hit the inside of the cup near its rim. After one crashing rebound that burst the buggy's shocks, momentum pressed us down on the curved surface. We had traction. I started pumping the brakes and steering.

The buggy zipped across the inside surface of the target, laying rubber all the way. You should've heard the tires screeching. We slewed crazily as I dodged vacuum-suited workers, open hatches, and miscellaneous junk attached to the surface. I managed to wrestle the buggy through a ninety-degree turn before we got to the opposite rim. We sped around and around the circumference of the target, dragging chains, rope, and wire, scattering buggy parts and smashing equipment as we went. Soon, the brakes burnt out. The tire treads went flopity-flopity-flop and flew off. I concentrated on keeping away from the edge of the target and on not hitting anybody. Fortunately, most of the workers, after the initial panic and stampede was over, thought to release their safety lines and jump away from the surface.

After several seconds of this, the buggy started to waffle around. As our speed decreased, we were losing traction, and I was having trouble steering. The target's main cargo hatch was gaping wide open, so I headed for it. We must've been doing about twenty clicks when we passed through the hatch into the airlock.

The buggy finally halted after totalling a small rocket taxi that had just been moved inside the airlock. The pilot of the taxi was sitting, unhurt, in his cockpit, paralyzed with astonishment. I could hear his breathing over my suit radio. Our train of jangling wires, chains, and other wreckage settled around us, and the airlock slowly filled with smoke from our smoldering brakes.

I grinned at the taxi pilot through the shattered windshield of the buggy. "Beep! Beep!" I said. ■

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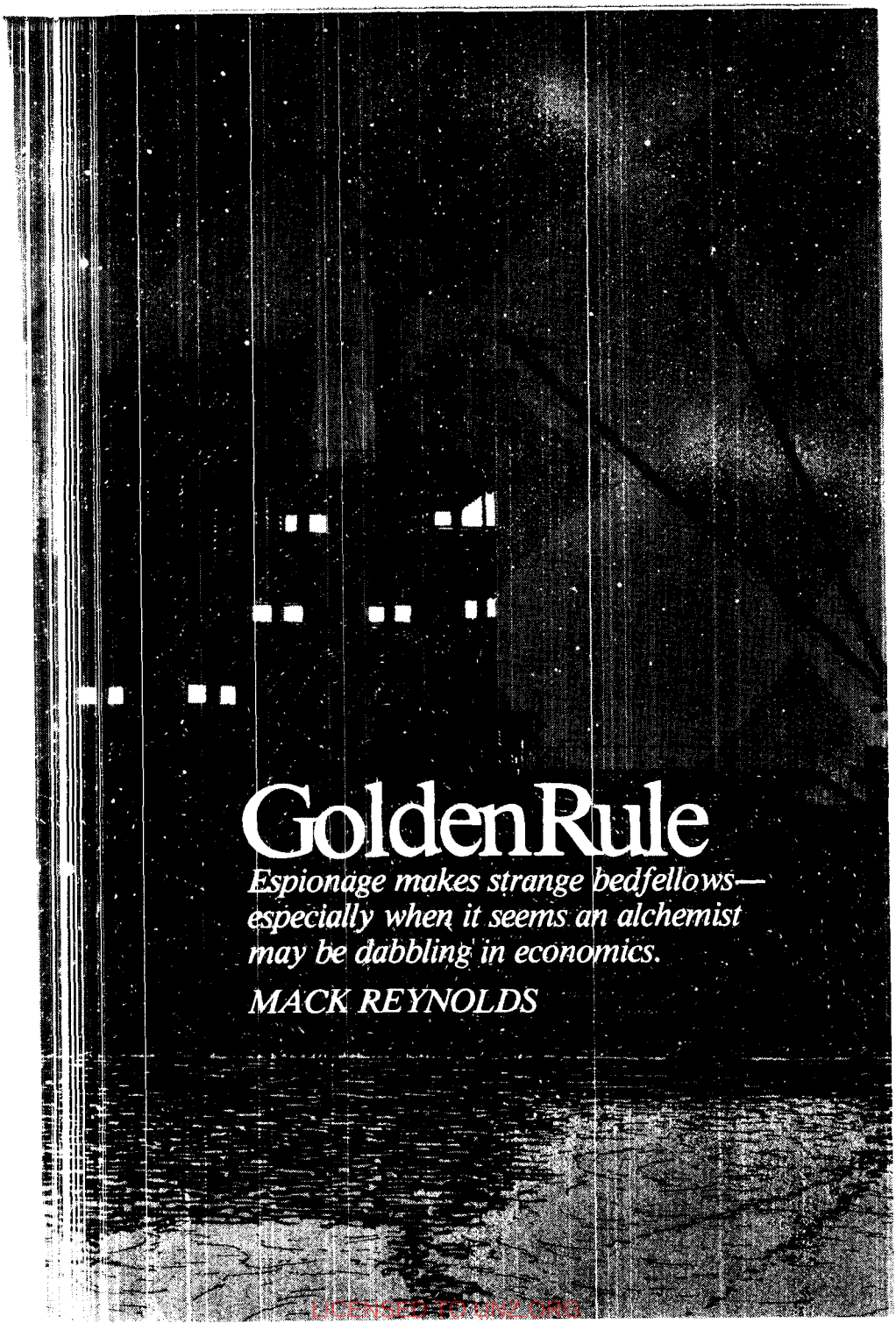

Golden Rule

Espionage makes strange bedfellows—especially when it seems an alchemist may be dabbling in economics.

MACK REYNOLDS

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"Curst greed of gold, what crimes thy tyrant power has caused."—Virgil

Paul slid into the booth across from his boss and said, "What's all the secrecy about? Since when have the commies been bugging your office?" He dialed himself a beer. They were in an auto-bar in the Baltimore section of Greater Washington and Paul had always liked Baltimore beer.

The Chief was irritated by his manner, which wasn't uncommon. His best field man Paul Kosloff undoubtedly was, but he was also an irritant seemingly not appreciating the niceties of their relative positions.

"It's not just the commies," he said testily. "Why did you think it had anything to do with the Communists?"

The center of the table sunk to return with Paul's beer. He took it up, made a half-gesture of toast, sipped and said, "You sent for me."

His superior squinted at his field man through pipe smoke, less than happily. He said, "Perhaps this involves the Sovs, but it involves one hell of a lot of people, especially influential people, in every country on the globe. We can't let *anybody* else in on it. There are already too many. What do you know about the philosopher's stone?"

Paul blinked at that curve. He said, "Never heard of.... Wait a minute. You mean like the alchemists? Roger Bacon and those cloddies? Draw pentagrams on the floor, pour three drops of a virgin's blood..."

The Chief was scowling at him.

Paul said mildly, "Wizard, what about the philosopher's stone?"

His superior tapped the stem of his pipe on the table. He said, "You're right about the alchemists. They were seeking the philosopher's stone, a method of changing base metals into noble ones. And the elixir of life, a means of achieving immortality. They were the forerunners of chemistry. In fact, where chemistry began and alchemy left off is moot."

Paul waited, sipping his beer.

The Chief said, "Has it occurred to you that in this modern age neither problem is unsolvable?"

Paul took another long sip of his beer. He was in no hurry.

The Chief went on. "Not using pentagrams and virgin's blood, admittedly, but in the modern laboratory."

Paul said mildly, "When they get around to a pill that gives immortality, let me know. I might think about taking one."

"I am not jesting, Paul, confound it. Please be so kind as to give this your full attention."

Paul said nothing, eyed his boss questioningly.

"We're interested in transmutation of metals. Did you know it was accomplished some decades ago?"

"No," Paul said.

"By the bombardment of elements with high-speed particles using such devices as the cyclotron." The bureau head added, "But the cost of producing, say, a single ounce of gold.... An ounce? A gram! Would be so ex-

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pensive as to be out of the question."

Paul said, drawing on his beer again. "Sooner or later we're going to get to the point."

The Chief said, "In the past couple of months, at least twenty tons of twenty-four carat gold have been dumped on world markets. A ton of gold, at present prices in Zurich and the other world markets, is worth some $9,600,000. That's at the rate of some $300 an ounce for nine-tenths fine gold."

Paul cast his eyes toward the ceiling in a quick bit of simple arithmetic. "That's almost two hundred million dollars worth. A lot of money. So what? Who sold it?"

"We don't know."

Paul shut up again. There was obviously more to come.

His superior dialed himself another brandy, in satisfaction at least that he had the other's undivided attention now. He even took the time to savor the cognac's bouquet a bit before going on. He said, "Technicians in the field can trace the origin of gold, tell you if your ingot came from Siberia or California, South Africa or Australia. The thing is that they don't know where this gold is coming from."

Paul said impatiently, "Look, you're talking about tons of gold and hundreds of millions of dollars and you tell me you don't know where it comes from. That's ridiculous. Who bought it? Who did he buy it from? You can't deal in hundreds of millions of dollars without . . ."

"That's the thing," the bureaucrat growled. "You can. In the free ports. In the open money markets in Switzerland, in Tangier, in Beirut. To a certain extent, in Hong Kong and Macao. Certainly in less reputable business communities in the Near East and India." He grumbled disgust. "We *know* about twenty tons. How much more of this stuff is hitting the world market, isn't clear. For that matter, we're not sure how long they've been pushing it. Perhaps for years."

"Pushing it? That's a counterfeiter's term."

The Chief stared at him.

Paul Kosloff cleared his throat. "Transmutation of metals. You think somebody's manufacturing gold. Why, that's ridiculous. You couldn't keep a secret like that."

"It would be difficult this side of the Iron Curtain," his superior nodded heavily. "Almost impossible. But in the Soviet Complex? The Soviet Union, China, or this new United Balkan Socialist Federation? As far back as the early 1960's they were peddling their Siberian and Sinkiang gold desperately for everything from grain to Western machinery. If somebody over there stumbled upon some method of transmuting lead, or whatever, into gold, our friends the comrades certainly wouldn't hesitate to drain us of our most valuable commodities and technology before we ever found out they were paying off with something all but worthless."

"It's fantastic," Paul muttered.

"There's an alternative," the Chief grumbled. "Possibly they've figured

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out some manner of mining the sea. The ocean contains some twenty tons of gold per square mile."

"Now we're really getting far out," Paul complained, rubbing the back of his hand along the line of his jaw in irritation that was evident.

"You think so? We extracted magnesium from the sea back during the Second World War in huge quantities and bromine in commercial amounts as far back as 1924."

Paul put down his empty beer glass and leaned forward. He said, "Now, let's get this. You say somebody is dumping tons of gold on the international money markets. You're afraid the Sovs or somebody have figured out some way of either manufacturing it or mining it from the sea so cheaply that they can milk the West dry if we continue to use gold as a medium of exchange, which admittedly the world is still doing although Switzerland is the only country left that's on the gold standard. I'm no economist but I suppose that's the reason she has the hardest money in the world."

"That's correct. That sums it up."

"And you want me to dig into it."

"Obviously."

"Any ideas on where to start?"

"No."

Professor Khmelnitsky entered his office briskly and Mikhail Rykov came to his feet to shake hands.

The professor said briskly, "And now can we hurry through this? I am afraid my schedule..."

Rykov sat down again and said, "Comrade Professor, we will take exactly as much time as I require."

The other looked at him, taken aback. He sputtered. In the Soviet Complex one did not address a member of the Academy of Sciences in such manner. Not for long years had anyone addressed Noraier Khmelnitsky with less than the greatest of respect. Why, a dozen times he had been entertained in gatherings where Number One himself was a fellow guest. Twice he had taken the Nobel. Why...

The professor said huffily, "I am, of course, at your full disposal, Comrade..."

"Rykov," Rykov said dryly. "Mikhail Rykov."

It was just then that Professor-Academecian Noraier Khmelnitsky first noticed the tiny red emblem in the other's lapel, the emblem that disclosed the bearer to hold the Hero's Combat Award for the Socialist Fatherland. The medal is not given lightly, any more than was the Blue Max of Imperial Germany, the Victoria Cross, or the Congressional Medal of Honor. When one carries the Hero's Combat Award, one does not bother to display any other decorations, military or otherwise, even when in full uniform. The professor's face went suddenly empty. Even a physicist, working as remotely as it is possible to work from the realities of every day, had heard of Mikhail Rykov.

He got out again, "I am at your full disposal, Comrade Rykov."

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"Of course. Now, tell me something about gold."

The other nodded. "The ingot submitted was twenty-four carats. There was little my associates could deduce from it, due to its purity. One seldom comes across a metal, Comrade Rykov, that pure outside a laboratory."

"Assume I know nothing about gold. Tell me about it."

The professor shrugged as much irritation as he dared. He held his terminology to what he thought a layman could easily follow. "Why, gold is a metallic element with the symbol *Au*. It is the seventy-ninth element in number and has an atomic weight of 197.2. It melts at 1063 degrees centigrade and boils at 2600 and has valences of one and three. Quite chemically inactive, it is unaffected by moisture and oxygen, is the most malleable of metals and very ductile. Only copper and silver are superior as a conductor of electricity. It reacts with the halogens and . . ."

The *Komissiya* agent held up a hand, his mouth wry again. "It is my own fault, I should have requested a bit differently. Tell me this, Professor, why has gold been chosen as the international medium of exchange?"

The other was somewhat out of his field now and he frowned. "Why, it is rare enough and difficult enough to find and extract to make it expensive. It is a beautiful metal so as to be desired as jewelry down through the ages. It has been found on all of the continents and being one of the first metals discovered, it has always had a universal appeal. A piece of gold is easily transported, comparatively, due to its value in relation to other metals, and, since it doesn't corrode, can even be sunk at sea for centuries and still come to no harm."

Mikhail Rykov wasn't getting what he wanted. He thought for a moment and said, "That ingot we sent you for your examination. What would you consider its origin?"

"Origin? Why, it was deliberately highly refined for laboratory use."

"But its origin. America, Common Europe, China, perhaps one of our own laboratories?"

"Why, any of them."

"No particular one? There was nothing in the ingot to indicate the country origin?"

The other looked at him blankly. "Any advanced nation has the facilities to refine that small amount of gold to its present state of purity."

Rykov took a deep breath. "That small amount, Professor, seems to amount to at least twenty-two tons."

"Don't be ridiculous."

The agent's eyes were guileless. He said nothing for a long moment.

The physicist cleared his throat. "What I mean is, there is no need for gold under ordinary circumstances to be refined to such a degree. The process is expensive."

"Nevertheless, Comrade Professor, more than twenty-two tons of such gold has recently come onto the world markets. The Kremlin wishes to know why."

"I am afraid that I am completely

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mystified, Comrade Rykov. It simply does not make sense."

Rykov took a deep breath. He said, "The following questions I am about to ask you are of the utmost security, Comrade Professor. Not even your closest colleagues of the Academy, not even your wife." He smiled gently. "Not even your mistress."

"See here, I am not used to being threatened!"

Rykov's voice was even. "Then you will become used to it quickly, Comrade Khmelnitsky. The security of the People's State is at stake."

The other seemed to shrink, infinitesimally. In his time, a thousand of the outstanding scientists of the world had come to their feet and applauded as he strode to the podium at Stockholm to receive his award. Even his voice was smaller. "Very well, Comrade."

"Then, this. Is it possible that the ingot of gold you examined was artificially made?"

The other's eyes widened in absolute surprise. "Do you mean a practical method of transmutation?"

"Exactly that," Rykov said flatly.

"But the ingot is a whole kilo! 2.2 of Western pounds."

"A common size, Comrade Professor, on the international gold market. We know of twenty-two tons of such ingots. Most of them in New York or London by now, but part and parcel of the world's gold supply. Comrade Professor, do you realize what effect it would have on the Soviet economy if gold suddenly became as cheap as lead? Why, for decades we've been using our precious metal production as the basis for our most necessary purchases abroad."

The physicist was shaking his head. "Yes, we can produce tiny amounts of gold in the laboratory. If we could devote a crash program to it, possibly in a few years we might achieve to the point where we could manufacture small quantities of it. But the cost!"

Rykov leaned forward, eyes narrow. "What cost? Research? Labor? Expense of building the equipment? Raw materials? What cost?"

The professor sank back, still shaking his head. "Largely power. The original plant, yes, very expensive, but above all, power. The amount of power required to turn out amounts of gold enough to be saleable would be astronomical."

"But it could be done—given the needed power?"

"I... I think so. I am not sure. I would have to..."

At the ferry, Paul Kosloff bought a ten cent, Hong Kong, seat in the second class and joined the surging hundreds crossing the gangplank.

He found a place on a bench near the bow and watched the ship-packed harbor. Junks from the Communist mainland, Arabian dhows with their lateen sails, automated tankers from the Persian gulf, bunkering here on the way to Japan, and merchantmen from every country known. Most were anchored at buoys in the larger, storm protected bay. Paul Kosloff idly

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picked out nationalities as the ferry hurried across to Hong Kong proper. The *Capri*, an Italian from Naples; and there was a rusty Victory Panamanian, undoubtedly American owned, carrying a flag of convenience to escape union wages; and over there a Japanese ship from Kobe, whose name he didn't catch, and beyond it, the *Lika*, a Yugoslavian Line motorship from Rijeka; and there, an American passenger freighter from San Francisco, the *T. W. Drennen*.

Around and about the ships plied the bumboats, Chinese craft bearing artificial flowers and handicrafts in usually vain effort to sell to crew members who hadn't shore leave.

They were on the Victoria side and Paul Kosloff joined the mob of hurrying Chinese debouching onto the pier. Of all the peoples he had ever known, none hurried as did the Chinese. They trotted, rather than walked.

Happily, in view of his desire for anonymity, the place he was looking for opened off a small arcade which contained half a dozen stalls, booths and tiny shops, specializing in tourist items. He spent a few minutes in the arcade, finally ascending the stairway to the second floor, as though seeking further booths.

The office was lettered, inconspicuously, *Kung Boon Haw*, and then *International Investments, Hong Kong, Shanghai, Beirut, London*.

The door opened, the knob held by a bespectacled Chinese girl who looked as though she wouldn't go much beyond sixteen, was pretty in the Northern Chinese tradition and wore her *cheon sam* as though she wasn't quite old enough to be garbed in such sophisticated dress.

Her English was as good as Paul's. She said, "What can I do for you, sir?" with the vaguest of bows.

Paul said, "I would like to talk with Mr. Kung. Sorry, but I haven't got an appointment to see him."

She had stepped back and he followed her into the room beyond. There was a desk, two chairs, a portrait of the late Chiang Kai-shek upon the wall, little else. There was another office beyond.

He said, "You can tell him it is about gold." Paul hadn't offered his own name nor did she ask it.

She left and his eyes followed her, thoughtfully. There was precious little in the way of sinister atmosphere here.

Kung Boon Haw turned out to be one of those ageless Chinese, quite thin, very quiet and very expressionless. His beard was so thin you could all but count the grey hairs. He wore traditional Chinese robes, rather than Western dress.

He sat behind an ancient desk which was free of all except a small sheaf of papers and an abacus; a Japanese style abacus, with its single line of beads on the top side of the horizontal bar, rather than the double line of the Chinese.

He said, his English not quite so impeccable as that of the girl, "You are interested in gold, yes?"

Paul Kosloff said, "An organization I represent is interested in a sale of

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gold ingots you made through Beirut to the Moroccan Bank of Tangier. It amounted to fifty, one kilo ingots."

Kung eyed him. "And the reason for your interest, sir?"

"For the moment, could we avoid that? I would like to know the original source of the bullion."

"I have not admitted to any such transaction, sir, but to satisfy my curiosity, why do you wish to know?"

Paul tried to avoid that again. "Could you tell me just one thing? Did the gold originate on the mainland, in the People's Republic, in short, in Communist China?"

The Chinese said, without inflection, "We seem to get nowhere, yes."

"I'll put my cards on the table. The interest of my organization in the gold ingots is because of the purity of the metal. As you possibly know, bullion is seldom more than nine-tenths fine. There is not need for it to be."

"Why should this interest you?"

"It occurs to my organization that someone has discovered a process of refining gold to a very high state of purity by an economical method. If so, it might prove useable industrially applied not only to gold but to other metals." He was working on the hope that the dealer in precious metals would not be up on this aspect of the commodity in which he dealt.

Kung ran a thumb along the top row of beads of his abacus, aligning them along the edge of the frame, as though preparatory to doing a problem.

Paul took a further chance. "There is no need, sir, to deny your hand in the transaction. We are also aware of the fact that certain Hong Kong banking regulations were, uh, sidestepped. However, this doesn't interest us. We are intrigued by where you procured the ingots in question. We have traced them this far back."

Kung Boon Haw sighed. "So you threaten to inform the authorities."

Paul Kosloff decided to play it tough. He growled, "All right, I'll lay it on the table. You've got connections with Red China. They've been smuggling out gold to you and you've been selling it on the free market in Tangier and Beirut. You admit that, don't you?"

Kung said gently, "My dear sir, I am a refugee from China."

Paul snorted exaggerated scorn.

The old Chinese said, still gently, "I submit that if the government of the People's Republic wished to sell any of their gold production through Hong Kong, they would do it openly, as always, through the Bank of China, the largest bank in this city and owned by Peking, yes. Why should they bother dealing through me?"

"I don't know," Paul snapped, still maintaining his tough front.

Kung shrugged his thin shoulders. "I do not know where the ingots of which you speak originated. I deal with many customers. I buy, I sell. Short of the obvious precautions, I do not inquire too closely about the business of my contacts. I am not positive, but I don't believe that the bullion in which you are interested originated on the mainland of China.

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I can tell you no more, yes."

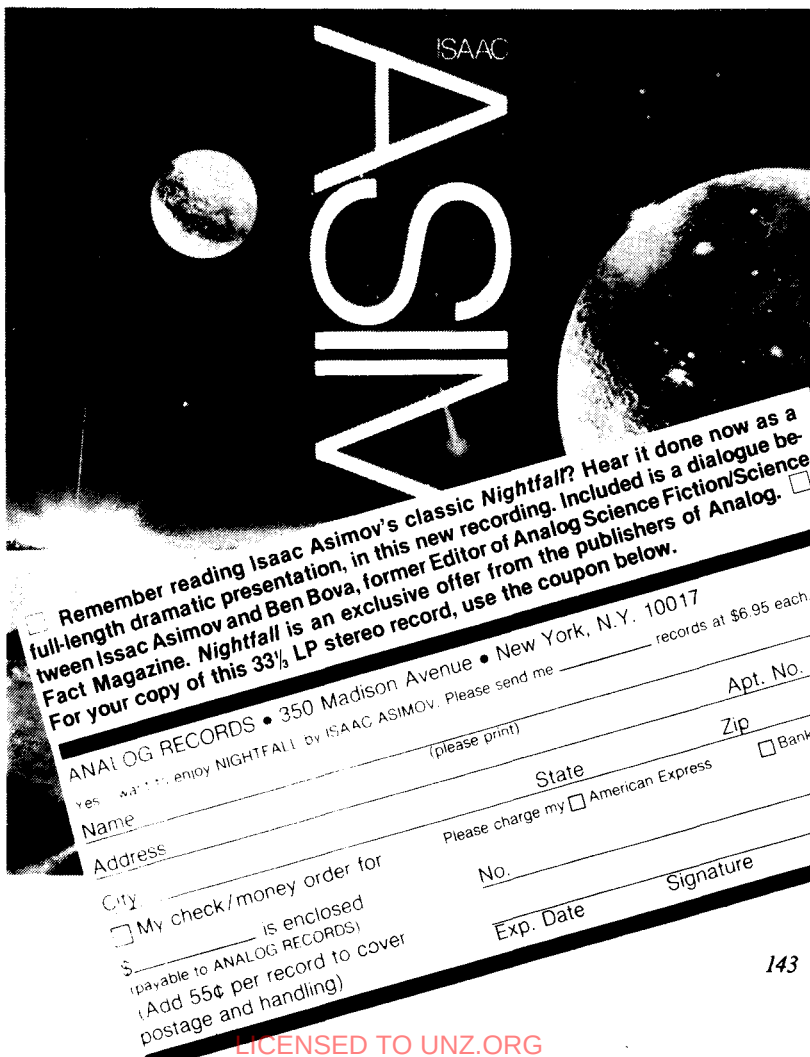
"Who sold it to you?"

"Actually, I am under no compulsion to answer, however, I do not mind disclosing that the man was unknown to me, but had been recommended by a colleague in Bombay. He was a European who spoke English, but it was not his native tongue."

"Was he a Russian?"

"I do not know. It is difficult for us Orientals to tell the difference between you Caucasians."

The Capitol Winter Gardens was located at 221 Nathan Road, not too far from his hotel. Paul had dined there once before, several years ago,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while on a comparatively minor assignment for his department-of-dirty-tricks which involved smuggling a defecting Chinese scientist out of Canton and to Hong Kong and hence to the United States of the Americas. It was one of the best restaurants in which he had ever eaten.

The headwaiter offered a huge menu, but Paul said, "Your duck was recommended."

The other bowed, smiled, said, "It is our specialty, but, sir, the Peking duck is very large. It should be served to four people at the least. You see, you must take the whole duck, it is not possible to order but a portion."

A voice, one table away, said in only slightly accented English, "We should join forces. The Peking duck here was recommended to me too."

Paul looked at the other. A man in his mid-thirties, tallish but solidly built, open of face.

Paul Kosloff rose, bowed as formally as an American can bow, and said, "Won't you join me, sir? It's a shame to eat alone, especially in a Chinese restaurant. And, as you say, we both wish to try the Peking duck."

The waiter went off, pleased.

They looked at each other speculatively. Paul said, at last, "Your wound doesn't seem to show."

Mikhail Rykov ran a thoughtful finger down along the side of his cheek from temple to chin, as he sat at Paul's table. "Our plastic surgeons are as good as your own. Where did you learn to use a knife like that?"

Paul said, "Our karate instructors, paratroopers, rangers, and judo specialists, are as good as your own."

Rykov chortled a bitter laugh. "Evidently, even a bit better when it comes to knife work."

"Shall we stop the niceties?" Paul said, his voice flat now.

Rykov looked at him. "Are you so sure it is necessary? We seem to be working on the same assignment."

Paul Kosloff's voice was cold in rebuff. "I have never known an occasion where I would have profited by cooperating with a...Red."

"Times can change," Rykov said. "For years, East and West cooperated in eliminating the mad dog Hitler."

"Afterwards, we only found a madder dog among us," Paul said. "It is difficult to forget the suppression of Hungary, Czechoslovakia, and East Germany."

The Russian flushed angrily. "Perhaps it will take history eventually to decide just who was the mad dog among the nations," he retorted. "And how do you think she will deal with Vietnam?"

Paul Kosloff's eyes were narrow. He had long since shifted his shoulder so that the coat lapel fell open slightly, his .38 Noiseless available.

Rykov grunted and leaned back in his chair. "Already we are acting like fools," he said. "I suggest that we join forces."

"Why?"

Rykov's nostrils widened, in restrained anger. "Because we are trying to accomplish the same thing."

"What would you say that was?"

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"Finding out who is dumping what might be artificially manufactured gold on the world market and by so doing threatening to overthrow what is still actually the international medium of exchange."

Paul said slowly, "In spite of your offer to cooperate, Rykov, I still suspect that the Soviet Complex is behind it."

"Don't be an ass. We have as much to lose as has the West. The sale of our Siberian gold is our single best source of foreign exchange. Besides that, our own currency is based on gold."

Paul Kosloff said, "However, my inclination is still to avoid any cooperation with either the *Chrezvychainaya Komissiya* as a unit of the Soviet government, or you as an individual, Rykov. Our record doesn't show it to be profitable."

"Ah. the Western claim to a monopoly of virtue, eh? Did it ever occur to you, Kosloff, that you watch your good guys and bad guys Tri-Di and cinema a bit too much?"

Paul Kosloff, for the first time, was inwardly amused. He had evidently gotten to the Russian agent. "Well, no, it hadn't," he said mildly.

"Very well," Rykov snapped. "You have no desire to cooperate. Remember, the offer was made!" He snatched his wallet from his pocket, pulled a bill from it and flung the money to the table. He came to his feet to storm away.

The Chief's face was in the tiny TV screen of Paul Kosloff's Tracy. He was saying impatiently, "We've got to get somewhere with this..."

We yet!

"...Paul. The lid can't be kept on much longer. We're beginning to suspect that Switzerland has smelled a rat. And remember they're still the financial clearinghouse of the world and the only nation still on an open gold standard. Yesterday, our treasury people bought two more tons of the new gold. It came through London and they'd purchased it through Switzerland from Beirut. What did you discover in Beirut?"

"Nothing," Paul told him.

The Chief looked at him unhappily. "Do you need more assistance? The less men in on this, Paul, the better."

"The only men I've used were given assignments that wouldn't necessitate them having the full picture."

"What about Rykov?"

"I discovered he was in Beirut, too, but I didn't personally see him. I suspect that for the first time in the past ten years, the standing order for *Komissiya* hatchetmen to eliminate me on sight has been shelved."

"And in India?" the Chief asked.

"I think he was there, too. At least in Madras. Possibly Bombay."

"I have your report on Bombay here but haven't gone into it as yet."

"You won't find anything," Paul told him. "India is a madhouse when it comes to gold exchange. Anybody with spare capital sinks it into gold or jewelry as a hedge against inflation. As a result, half the gold dealings in the country are under the counter."

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"You think that this new gold has been peddled extensively in India?"

"If somebody is dumping gold and doesn't want it known, India and Pakistan are two of the best places on Earth I can think of. We know of some twenty-five tons of the stuff. There could've been another hundred tons secretly sold in India and no agency of the West would ever hear of it."

His superior held silence for a moment. Then, "Rykov's proposal for cooperation? We've discussed it here. Do you think it is sincere?"

Paul stiffened and his face went flat. He said emptily, "I don't know. My reasons for distrusting Rykov go back as far as I've worked for you and the Bureau. He has almost finished me on three different occasions."

"On the other hand, you've almost got him two or three times."

"Four."

"There's no room for personalities in the overall conflict between East and West, Paul," the Chief said unctuously. "We want immediate report if you are approached again on this matter by Colonel Rykov. Do you think he might be in Tangier?"

"I don't know," Paul Kosloff said.

"Keep me informed." The bureaucrat's face faded.

This was the end of the road. Time was running out. He either pulled a rabbit from the hat, here in Tangier, or he had failed in what the Chief had let him know was probably the biggest assignment of his career.

He was sitting at the Café de Paris, on the Place de France; a sidewalk café giving no indication that it was not located on the Riviera, rather than in North Africa, other than that the Moroccan waiters were in *sarousels,* the baggy pants of the Moslem.

He sipped at his Stork beer and ran it over again, with no more result than ever before. He had come to Tangier because through its multi-banking outlets had come a great many of the ingots in question. He had left the wide-open city until last because its far out institutions were such that it would be considerably more difficult to trace transactions than in such other free ports as Beirut, Singapore and Hong Kong.

But now that he was here, what? He sipped his beer again and watched the town teem by. Berbers down from the hills, striking their heavily laden burros on the way to the Socco market. Belgian prostitutes looking for afternoon customers. Moroccan peddlers trying to sell worthless junk to tourists with swollen feet. Shoeshine boys, so numerous that there must be two for each potential customer. Orthodox Moslem women wearing the veil and the *haik* but still, somehow, being able to project femininity.

His eyes shifted slightly to the left, to follow the progress of an unordinarily picturesque Blue Man down from the mountains of the interior. They shifted back, then returned in a double take.

From the table next to him, Mikhail Rykov smiled without humor. "The famous Lawrence of Arabia of the

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Cold War seems to be slipping," he said, a sharp edge in his voice.

Paul said, instantly under control, "Perhaps one of my men is covering me from a window across the street."

"And perhaps not," the Russian answered, not even bothering to look in the direction Paul intimated. He stood and slid over into a chair at Paul Kosloff's table, uninvited. "Your people are as anxious as mine to keep this matter in as few hands as possible," he said.

Paul said, distastefully, "I assume you haven't been having a good deal of success."

Rykov didn't answer that. He said, "My immediate superior has brought up, once again, the possibility of cooperation."

The American operative was under orders. He said grudgingly, "My own chief has requested that I forward any such suggestions. Cooperate in what manner? What has either of us to offer the other?"

The Russian obviously liked this no more than his American counterpart. However, he said, "Perhaps if nothing else we might have saved duplication of effort. We've both been covering the same ground. Neither of us has found the origin of the gold, but had we cooperated, as suggested in Hong Kong, we could have gotten this far in half the time."

Paul grunted. In spite of his superior's orders, he snapped, "Yes, and at the end, somehow, the West would find itself holding the bag."

"The West! The West?" Rykov snorted. "You and your West and your East. The capitalists and the communists. The democracies and the dictatorships. The blacks and the whites, without shades. When are you going to stop playing the same old tired tune?"

Paul Kosloff took a long pull at his beer. He said flatly, "When the West has won. When freedom has finally triumphed."

The Russian called to a passing waiter. "A fundador, double, without ice." He turned back to his opponent. "Look here, Kosloff, those slogans you mouth were coined two generations ago. They're antiquated. There's evolution in society, as well as in nature. The things that applied when you were a child, even when you were a young man, are gone."

Paul said, "Just what are you getting at?"

"I'm getting to the fact that things have changed, the simple blacks and whites no longer apply, if they ever did. Moscow is no longer in control of what you so glibly call the Soviet Complex. Under what you loosely call communism are half a dozen different socio-economic systems. Do you labor under the illusion that the government of Cuba and that of North Korea are the same? Or Mongolia and Poland? Today, the Chinese think the Russians are reactionary. Today, leaders of the United Balkan Socialist Federation such as Josip Kavurić are screaming that the Soviet Union has betrayed Marxism, and is standing in the way of the establish-

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ment of true socialism."

"So I have read," Paul said dryly. "Josip Kavurić, the radical radical."

"We are pragmatic," Rykov snapped. "We have adapted to the circumstances. Much of what Marx taught is antiquated. Today, many of the problems of Russia are those of America as well. Among them, the prevention of the collapse of gold as the international medium of exchange, which it really still is."

The waiter had come with the brandy the Russian had ordered. Paul Kosloff finished his beer and made motions for a fresh bottle.

When the waiter was gone, he said, "My heart is pumping borsht in sympathy with your sad tale, Rykov. The collapse of the East as a cohesive unit, however, fails to distress me to the extent you evidently wish. Frankly, my fondest dream is that the whole house of cards will collapse and freedom return to half the world."

"There you go again," the other said in disgust. "Do you think I was talking simply of the countries you brand as enslaved? There you are with your blacks and whites, your good guys and the bad guys. But even thirty years ago, your own so-called free world was a farce. Supposedly free were all such lands as didn't profess any degree of communism. In fact, your more far out rightists would add socialist to that and brand the Scandinavians and British with the same label. Actually, of course, the degree of democracy in Scandinavia and Great Britain was, if anything, greater than that of any other part of the supposed free world. For that matter there was at that time more democracy in supposedly communist Yugoslavia than in, say, Spain or Portugal. I won't even mention such Arab countries as Saudi Arabia and Iran as examples of your free world."

Paul said, "You're getting nowhere by the minute, Rykov. I'll admit the world is in a state of flux. Perhaps it always has been. But the basic battle for men's minds goes on. The West isn't perfect and only a fool would claim it is, or ever has been. But its principles are superior to those of your Soviet Complex and I, for one, continue to fight for them."

The Russian tossed back his brandy in a stiff wristed motion. His disgust was manifest.

"Very well," he said. "I offered cooperation in a common cause. You refuse it and mouth slogans that were largely nonsense even when coined and are now rot. However, I suspect that possibly some of your superiors are not quite so emotionally involved as you are, Kosloff. I suggest that you send this message back to them. That the Kremlin is of the belief that if gold is suddenly discovered to be all but worthless, the economies of both East and West will collapse in confusion. The Kremlin wishes to collaborate. Ordinarily, such a suggestion would go through more formal channels, but this is not an ordinary situation."

He stood up and fished in his pocket. "I seem to be continually tossing money on the table to you," he said

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with a grim and mirthless smile.

"Forget it," Paul said. "This one is on Uncle Sam."

"Ah!" the Russian said. "Our first cooperation."

"And the last, I hope," Paul said with a snort.

Paul Kosloff sat, stiffly and expressionlessly, in a reception room, briefcase on lap, until the male secretary ushered him into the presence of a heavy-set, sharp-eyed Tangier stereotype who could have been Syrian, Lebanese, Armenian, or Moroccan Jew—the businessmen of North Africa and the Near East.

"Mr. Foster," he beamed at Paul Kosloff, extending a plump, well manicured hand.

Paul beamed back, somewhat more stiffly, as though the amenities came difficultly to him. They shook hands. "Mr. Zubillaga," Paul said.

Mr. Zubillaga saw him to a chair, anxious about his comfort, then sought out his own desk. "A glass of mint tea?" he said. And then, hurriedly, "or perhaps you prefer something stronger?"

"Mint tea would be excellent," Paul said primly. He was dressed in the most conservative business attire, his suit obviously from Bond Street, his very sincere shoes from Dublin. His briefcase looked as though a small fortune had gone into its manufacture, whatever the contents.

Mr. Zubillaga must have pressed a button, unnoticed to his visitor, since the tea wasn't mentioned again until it arrived. He leaned forward, arms on desk and looked at Paul enquiringly.

Paul said, "You have been recommended by a mutual...friend. My principals have instructed me to purchase ten million dollars worth of gold bullion."

There was never a blink. "Very good. And in what currency do they wish to pay for the shipment? In American dollars?"

"In Greek drachma."

The other pursed lips. "The drachma seems to be a bit on the soft side these days, Mr. Foster."

Paul nodded. "We are willing to accept whatever the current rate on the Zurich market."

There was a discreet knock on the door and a Moorish servant in *sarouel* pants, *bedaya* waistcoat with embroidered buttons, and the *jebador* Moorish coat, came in with a large brass tray on which were two glasses of the heavily sugared local mint tea. He served and withdrew, silently.

Paul sipped politely.

The gold dealer said, "And may I ask the destination of this shipment, Mr. Foster?"

Paul Kosloff looked at him emptily.

Mr. Zubillaga put up his chubby hands in supplication. "Please do not misunderstand. In Tangier, we do not question the business of our clients. However, there are certain considerations. I would assume that your principals have been making some business transactions which necessitate payment in gold. Very well, if the exchange is to be made, say, here in

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Tangier, I can simply give you a note of transfer and your consignee can pick up the bullion whenever he so desires, or, if he wishes, have it exchanged into any world currency. However..." and here the dealer cleared his throat "...if the destination of the bullion is North America, I can give you a transfer on one of our New York banks."

Paul said stiffly, "We wished the bullion in the form of ingots, to be picked up here."

The other hesitated. "No problem," he said. "However, one question. Is the destination either India, Pakistan, or any of the Indo-Chinese regions?"

"Why do you ask?" Paul said stiffly. "Your concern was recommended on the basis of its discretion."

The hands came up again. "Merely to know what size ingot you would wish. May I suggest that if its destination is any of the mentioned countries that we deliver it in one-kilo bars?"

Paul Kosloff pretended to relax. "I see," he said. "No, the bullion is not meant for India or the others. Ah, I might say that it will eventually go into very legitimate channels."

"Why, of course, sir."

Paul Kosloff said, "Now, one other item. My principals would like to know the origin of the bullion."

"I beg your pardon?"

"The origin of the gold. Where it was mined."

"My dear Mr. Foster, how in the world would I know?"

Paul pretended to be nonplused. He looked at Zubillaga and frowned.

Mr. Zubillaga said, "For what purpose is this knowledge needed?"

Paul, still frowning, shrugged. "They asked that I be so informed."

"Gold is gold," the dealer said, shrugging as well.

"You can't tell me if the ingots in question are originally from Siberia, Sinkiang, South Africa, Australia?"

"Perhaps all of these. Who can say?"

Paul twisted his face wryly. "I will be frank, Mr. Zubillaga. I am dealing for an American syndicate. They are, shall we say, a bit chauvinistic. They insist that the transaction not redound to the ultimate benefit of the Soviet Complex."

Zubillaga chuckled deeply but without humor. There was no humor in the man. Kosloff felt his sudden relief and the disappearance of suspicion.

The gold dealer said, "That is one guarantee I can give you, Mr. Foster. The ingots will not have originated in either the USSR or China."

Paul followed along, chuckling stiffly himself. "Silly, actually, isn't it? As you say, gold is gold. But if you say you don't know its origin, how can you be sure that it didn't originate somewhere in the Soviet Complex?"

"Because, Mr. Foster, the various banking houses which I represent are motivated by the same, ah, chauvinism you mention. They refuse to deal with the Sovs in any capacity."

He could get no further along at this point, Paul decided. He came to his feet. "Very well, sir. I shall take no

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a calendar of upcoming events

log

7-9 March
HALCON 3 (Atlantic Provinces regional SF conference) at Saint Mary's University, Halifax, Nova Scotia. Guest of Honor—A.E. van Vogt. Toastmasters—Spider and Jeanne Robinson. Special Guest—Alfred Bester. Registration $5, $10, $15 until February 1, $6, $12, $21 thereafter. (All money in Canadian funds.) Info: The Halcon SF Society, P.O. Box 3174 South, Halifax, Nova Scotia Canada B3J 3H5.

7-9 March
WISCON 4 (Wisconsin SF conference) at Madison, Wis. Professional Guests of Honor—Octavia Butler and Joan Vinge. Guest Editor of Honor—David Hartwell. Fan Guest of Honor—Bev DeWeese. Registration $8 until February 29, $10 at the door. No registration March 1-6. Info: SF3, Box 1624, Madison WI 53701.

28-30 March
NORWESCON 3 (Pacific Northwest SF conference) at Airport Hyatt House, Seattle, Wash. Guest of Honor—Alfred Bester, Fan Guest of Honor—Fred Pohl. Art show, films, masquerade, computer games, hucksters. Registration $8 until February 14, $9 until March 27, $10 at the door. Info: Norwescon 3, P.O. Box 24207, Seattle WA 98124.

29 August-1 September 1980
NOREASCON TWO (38th World Science Fiction Convention) at Sheraton-Boston Hotel and Hynes Civic Auditorium, Boston, Mass. Guests of Honor—Kate Wilhelm and Damon Knight, Fan Guest of Honor—Bruce Pelz, Toastmaster—Bob Silverberg. Registration $30 until July 1, 1980, non-attending membership $8 at all times. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Noreascon 2, P.O. Box 46, MIT Branch Post Office, Cambridge MA 02139.

ANTHONY LEWIS

Items for the Calendar should be sent to the Editorial Offices, four **months** *in advance of the issue in which you want the item to appear.*

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more of your time. Within the week, I will contact you. I assume that with the producing of the drachma, the ingots will be immediately available?"

Zubillaga stood too, beaming again. "Immediately, Mr. Foster."

Unsuspecting, Paul Kosloff's quarry passed by the Yacht Club and headed in the direction of the Port de Peche and the fish market.

Paul knew the area. Besides being a fish market and the wharf utilized by the fishing craft which worked the Straits of Hercules, between Europe and Africa, it was also the home of the several score smuggler craft based in Tangier.

There were quite a few sports fishermen, optimistic, even at this late hour, sitting along the gigantic rocks which had been dumped here to form the artificial jetty. Paul wasn't conspicuous but he kept his distance. When it could have become obvious that he was following the other, he dropped behind, took his place on a rock and dipped his hand into his right pocket for the night glasses.

Zubillaga, still seemingly innocent of the knowledge that he was being followed, stepped into a waiting motorboat at the end of the jetty and the small craft immediately took off into the main harbor. Paul watched it for a moment from his present point, then, when it was out away, walked further up the pier and took a new position. The night was clear. So clear that he could even see the Spanish coast in the distance. The motorboat continued on its way.

In the harbor were anchored a dozen ships, waiting, undoubtedly, for room at the limited docking area. Tangier was a-booming these days and ships outnumbered docks. Only the hydrofoil ferries which ran back and forth to Gibraltar could always find space.

Zubillaga's craft was pulling up alongside a freighter. An old style, unautomated freighter, antiquated among the new super-vessels being turned out in both the East and West. Paul Kosloff squinted through the glass to take in the name and home port. The *Lika* of the Rijeka, which would mean the United Balkan Socialist Federation.

The *Lika*? Paul grimaced. The *Lika*?

But something was stirring in Paul Kosloff's memory even as he watched the gold dealer scramble up the Jacob's ladder and disappear into the ship's interior.

The m/s *Lika* of the Yugoslavian Lines, the dominating shipping syndicate of the United Balkan Socialist Federation.

He was stretched out on his bed at the Djenina Hotel, his hands behind his head, his shoes on the spread, unnoticed, and letting it come back to him. He had left Kowloon and taken the ferry over to Victoria, Hong Kong. On the way over, he had idly noted the ships at anchor. The m/s *Lika* had been among them. Now she was here in Tangier and immediately

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after he had given Zubillaga an order for gold, the dealer had made his way to the ship.

Paul Kosloff had gone to Hong Kong because several shipments of the new gold had recently turned up there. When he arrived, the *Lika* was in harbor. Now he was tracing down similar rumors in Tangier and the *Lika* was here. Coincidence? Hardly.

He shook his head, unstrapped the Tracy from his wrist and set it before him on the small table the room provided. When the Chief's face faded in, it was already scowling.

"Look here, Kosloff," the other snapped, "are you getting anywhere at all?"

So, it was Kosloff, instead of Paul.

"I think so. Maybe," Paul said.

"Now, look here, Kosloff, time is running out. Rumors are chasing themselves all over Amsterdam, Dusseldorf and Milan. It's got beyond just rumor in London. The only thing that's preventing the greatest chaos that's ever hit free enterprise is fear. The ramifications are so unbelievable that everybody involved is terrified of acting. But the dam is going to bust any hour. You've flubbed this, Kosloff. I'm going to throw the resources and every operative of the Bureau into it. We've *got* to know where that gold is coming from."

Paul said, his voice very even, "You throw the whole Bureau into it and there'll be leaks at every level. Within the day, the word would get out that Greater Washington suspects the gold to be artificial. Then the fat will really be burning nicely in the fire."

"The fat's already in the fire, you incompetent fool! That's what I've been telling you!"

Paul's mouth was white. He said, without inflection, "I might have something. Give me until morning."

"You might have what!"

"I don't know," Paul said flatly. "Give me until morning." He flicked the tiny tight-beam off, and began adjusting it to his wrist. Its little summons alarm rang, but he ignored it.

He rented a small fishing boat with oars, rather than an outboard, and headed into the harbor.

The noise, as he rowed, irritated him. With sound as it is, over the water, he wondered that every seaman on every ship anchored or docked didn't hear him. However, he decided that the sounds of a harbor, even at night, would be such that it would have to be an astute watchman to catch his comparatively meaningless squeaking and splashing.

The *Lika* loomed before him, lit up neither more nor less than the other freighters about it. In other words, some lights in the living quarters amidships but dark at both prow and stern, save for anchor lights.

He approached the ten thousand ton cargo vessel in the shadows at the stern, tied his small craft to the ship's rudder and then took up his anchor rope. The small, three pronged metal hook at the end wasn't particularly heavy. He arranged the rope in circles at his feet, then spun the small anchor

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around and around his head. He cast high, praying silently to half a dozen gods he didn't believe in.

It clanged resoundingly on the deck above him, and he held his breath. He waited five minutes, but nothing developed. He slowly began drawing the rope back. After a yard or two had accumulated at his feet, he felt his anchor *cum* grappling hook catch. He put weight to bear and it held.

He stripped off his coat, loosened the .38 Noiseless in its harness. He pulled off his shoes, rolled up his sleeves, then took hold of the anchor rope, breathed another prayer that it would hold his weight, and started up. After a few yards, he minimized the effort required by walking up the ship's side, much as an Alpine climber would do on a cliff face.

He came to the railing and slung a leg over, jumped to the deck and headed for the shadow of the stern superstructure.

And ran smash into a heavy fist!

A voice barked in guttural Serbo-Croat, "Thief!"

It was the dark that saved Paul Kosloff. For a moment he was dazed. The world had gone white lightning. But the seaman's blow had failed to contact directly, through poor aim. It had glanced off his right cheek.

Paul rolled, stepped back, one, two, three, in the automatic shuffle of the trained boxer. He shook his head for clarity. The other was boring in, but in the excitement of the attack failed to shout for assistance.

The American operative was ready now. The other came rushing, sensing an easy victory and flinging a wild blow at Paul's head.

Paul threw a left inside block to ward away the other's right handed punch, then moved quickly with a right forward kick to the groin. A second later, he chopped with his right hand to the sailor's shoulder with all his weight behind it. The other collapsed under the karate attack, in writhing agony.

Paul stood for a moment. Silent. Listening. He could hear nothing about the ship to indicate that anyone else was aware of his presence.

He fished in a pants pocket, came forth with a small box. He selected a surette from it and pressed the tiny hypodermic into the other's arm. He assumed the seaman didn't have a bad heart. If he did, it was most likely curtains. Otherwise, nothing would result for a full twelve hours except a deep sleep. He rolled the man into the darkest shadow he could find and pulled some tarpaulin over him.

Paul walked forward brashly now, toward the ship's midsection and living quarters.

The *Lika* seemed all but empty, even as he hurried into the shadow of an iron ladder leading up to the second deck. That made sense, though. The crew was undoubtedly largely ashore on leave. It would have looked suspicious if they hadn't been.

He had no idea of what he was looking for but if his instincts were correct, this bottom deck would be devoted to the crew, galley and the crew's mess,

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laundry and so forth. If there were special passengers aboard, they would be above, along with the officers.

He went up the ladder, trying to look as though he belonged. The top was in shadow and as he reached the deck, a figure started down. Paul Kosloff tensed but continued on his way, his arm held so as to hide the holster of his weapon. The other grumbled something in Serbo-Croat and Paul grunted back, "Yes," in idiom of the same language and went on.

Evidently, the other failed to notice that he wasn't a member of the regular ship's complement and continued on his way. Paul blessed the darkness.

Paul Kosloff took a deep breath and pressed on. He was playing it by ear now. He didn't know where he was going, what he was looking for. He entered through a heavy steel door and into a lighted corridor. It was empty. He went on down the corridor. There were cabins opening off to the left but the right was evidently the bulkhead of the engine room.

It was a hot night. Some of the cabin doors were half open, on hooks, but the rooms dark, probably occupied by sleeping junior officers.

The third cabin was lit and the door open. He was going to get no further undetected. Well, there was no particular reason for trying to scout out the whole ship in secrecy even if it could be done, which was unlikely.

Paul Kosloff looked brazenly into the cabin.

And stared.

The man seated easily at the room's desk, a book comfortably before him, was hardly an unknown. Most certainly he was not an unknown to Paul Kosloff, troubleshooter of America's top anti-communist agency. For though the founders of the socialism of the 19th Century were almost universally disregarded in this, the end of the 20th, Josip Kavurić stood out as a working scholar of their theories. Who was it had called him sneeringly the *last of the Marxists?* Probably one of the more recent socio-economists being turned out wholesale by the University of Moscow.

Josip Kavurić, theoretician of the United Balkan Socialist Federation, who dominated the councils of this latest addition to the world's political blocks, and fulminated as strongly against the members of the Soviet Complex as he did against all of the strongest bastions of the West. Josip Kavurić, the uncompromising.

Things were just beginning to clear to Paul Kosloff.

The other looked up. He was a man in his early sixties and affected a beard similar to that once worn by Friedrich Engels, Marx's collaborator. He smoked a huge, curved stem pipe and his carelessly worn clothes had ashes dribbling over coat and unpressed pants. He didn't look as though he belonged to this era, possibly not even to this century.

Kavurić looked up even as Paul Kosloff entered, closing the door behind him.

The old man's eyes took in the quick-draw harness which held the .38

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Noiseless which Paul Kosloff knew how to use so well. His glance went down to the intruder's bare feet, then up to his face.

Paul Kosloff said in Russian, "The jig is up, Kavurić."

The old man marked the place in his book and set it down on his desk.

"Indeed," he said. "An Americanism, I believe." His eyes were level and unafraid. Paul Kosloff remembered that the man, when little more than a child, had spent time in the mountains as a partisan against the Nazis, and, later in life, ten or more years in various prisons.

The old man added, "Under what authority do you intrude upon this ship, and upon me?"

Paul tapped the .38 Noiseless. "This authority. Or did you labor under the illusion that only the commies had tough operators?"

"No, I did not," Kavurić said. "What do you want? Do you have a name? You seem to know mine."

"Kosloff," Paul said. "Paul Kosloff."

The other's eyes flickered only slightly. "I see. A hoodlum, I understand, serving the imperialists."

"That's one way of looking at it," Paul said dryly. "I see myself as a first string field man on the team of the West. However, the point is that the jig's up. No more dumping of highly refined gold, in pseudo-secrecy, on the world markets in hopes of setting off a panic and collapsing international exchange." He added, after a slight pause, "By the way, where do you get it? Some new strike back in the boondocks of the Balkans somewhere?"

Whatever the world thought of his theories, no one of either West or East had ever branded Josip Kavurić a liar. It was his painful inability to conform, to knuckle under, that had led to his imprisonment time and again, under Mussolini, under Stalin and finally under Tito.

He said, "The gold strike was made in Montenegro, near Bijelo Polje."

Paul Kosloff was figuring this out as he went along, but he pretended knowledge he hadn't. He found himself a seat on the lower bunk of the cabin and said conversationally, "So instead of just marketing it, and using it to help develop the United Balkan Socialist Federation industrialization schemes, you went to the bother and expense of highly refining it, and putting it on the world market through minor dealers in free ports."

The Balkan socioeconomist was interested. He had put down his heavy pipe, now he took it up again, knocked out the ash, and began to refill it.

He said calmly, "How did you discover this?"

"The whole thing didn't hold water very well," Paul told him, keeping his own voice on the same level of calm conversation. He was milking all he could get, still not having the complete picture. "Your Tangier agent, this Zubillaga, let one cat out of the bag when he all but admitted that he didn't want the gold to go to India or

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any other country where it would be swallowed up in real secrecy. It was to be sold in such manner that it was practically guaranteed to show up eventually in London, Switzerland or New York, where sooner or later its purity would cause comment."

"I see," the other said, as though in resignation. "Then the story is out."

It wouldn't hurt him to think so, Paul decided. He said, "The scope of the idea is fantastic. I don't see how you expected to put it over."

The old time revolutionist was irritated. He lit his pipe, breathing deeply. He shook the burnt out match at Paul, before dropping it into an overladen wastebasket. "The political economists of the 19th Century didn't foresee some of the developments of this one," he complained.

Paul Kosloff twisted his mouth wryly, but held his peace.

Kavuric went on. "The degree to which state capitalism . . ." he sneered, ". . . some call it *state socialism*, or, even more ridiculous, just *socialism*. At any rate, the degree to which statism would evolve was underestimated. It was thought that economic depressions would get progressively worse, come progressively more often, until finally the working class would revolt and seize control of the means of production. It was not foreseen that governments would be led to plow back into the economy billions of what it had to drain out in the form of taxes. It was not foreseen that a second industrial revolution would come along, necessitating a more highly educated working class, a better fed, alert, healthy, adjusted working class, to handle the new technological developments. That government would become the largest single industry of all and that the major proportion of the individual nation's income would be spent on armaments, public works, sending rockets to the moon, or wherever—all to the end of preventing further economic collapses of the type known before the Second World War."

Paul said, conscious of time, "What's all this got to do with the United Balkan Socialist Federation dumping slicked up gold on the world money markets?"

The socioeconomist was impatient. "The goal of our federation is still world socialism, my friend. And if the revolution is not to be realized by the old method, that is workers arising in hunger brought about by economic depression, then we must invent new methods."

Paul stared at him, getting further glimmerings of the complications of the whole truth.

The old man smoked angrily for a moment, as though the realization of failure was only now coming home to him. "In spite of the fact that most nations have abandoned the gold standard, still business, international commerce, *all* trade, is ultimately based on gold," he pontificated. "If, overnight, it was decided that gold was worthless, there would be a collapse of such proportions that the depression of the 1930s would seem

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relatively prosperous. At such a crisis, once again the workers, in despair, might listen to the message of socialism, real socialism."

He shook his head at Paul's expression. "I do not say that given *time* the Western economists might not come up with an answer. But the chaos would be upon them before given this time. All money would become mere paper, with nothing of value to back it. Can you imagine conducting business without money?"

Paul was shaking his head in disbelief. "Do you mean you were able to sell this harebrained scheme to your government?"

The old man snorted through his whiskers. "Why not? What could we lose? A few million dollars? We mined our gold and spent a bit more than usual refining it beyond the point the trade is used to. We then sold it on the world markets for a trifle less than ordinary. What have we lost? Our gold production is not really high. About thirty tons in all, thus far, and the mines are running out. But we produced enough for our gamble."

"I suppose," Paul said, "the Russians and the others of the Soviet Complex are backing this..." As he spoke, he was unstrapping the Tracy from his wrist. He might have trouble getting off the *Lika* and wanted to get this report through to the Chief immediately.

Josip Kavurić was an old man. The beard gave him a rather father-image projection. His voice was slow and invariably even. He smoked the pipe with great deliberation. On the other hand,

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Paul Kosloff, with fifteen years on the battlefields of the Cold War, was one of the quickest draws ever turned out of the Bureau's combat training school. So it was that Paul Kosloff, troubleshooter extraordinary, cold-eye victor in a hundred unpublicized skirmishes between East and West, had no expectation of this confrontation developing into violence.

The Tracy, which he wore on his left arm, on the inner side of his wrist, was being pulled off with his right hand, when the aged socioeconomist, in the process of stroking his beard, emerged suddenly with a gun.

His wrinkled and heavily veined hand trembled not at all. And he said, as evenly as ever, "You will drop that immediately, sir, and then you will sit on your hands."

In his time, Paul Kosloff had taken his chances, when covered by an opponent, and even at this short range. However, the caliber of this gun was at least 9mm. Besides, Paul had read Kavurić's dossier and the man had spent years in the underground and as a guerrilla and obviously knew how to handle his weapon. Given the need to see his scheme through, he would not hesitate to kill. In fact, Paul wondered why the political economist hadn't already fired.

Inwardly chagrined, Paul Kosloff sat on the bunk, on his hands, and stared at the other. The Tracy he had let drop to the floor.

The gun steady, his eyes boring into those of his American opponent, Josip Kavurić came to his feet, took one step, then ground his heel down upon the diminutive, tight-beam communicator. He returned to his chair.

He said, "And now, my friend, we shall sit and wait for half an hour or so. I deduce from your attire that you have sneaked aboard, unaccompanied. And further, from your words, that you actually had little idea of my plan's scope; indeed, still don't. If that applies to you, then it undoubtedly applies to your superiors. The captain and chief mate will return to the ship shortly, with the latest on how our little scheme is being received by the world powers. My deductions are that tomorrow will see the beginning of the end."

Paul looked at the other, estimating again his chances of taking him, pistol or no pistol. He regretfully rejected the idea. Had the Tracy still been in existence, he might have made the attempt. Even if the off-beat socioeconomist got him, he could have had time to get the report through. But now, even with no more than a gut wound, it would be all but impossible for him to get ashore and to a radio, before going under.

Kavurić said conversationally, "You betrayed the fact that you actually knew little of our strategy when you asked if the Russians and the rest of the Soviet Complex were in on it. You fool! Don't you see the point? It is aimed *at* the Soviet Complex as well as the West. They have betrayed the revolution. Stalin, Khrushchev, Brezhnev, the present Number One—all of them! So far as the working class

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is concerned, what is the difference between the West's free enterprise and the Soviet Complex's state capitalism? Under one, you work for a private owner of the means of production; under the other, you work for the state. All the trappings of capitalism are there; wages, money, banks—all the institutions the founders of scientific socialism pointed out would disappear after the revolution."

Paul strung along, waiting for opportunity. "What in the devil would you replace money with?" he said nastily. "Barter was fine in a one-horse primitive economy, but you can't run a modern, industrialized nation without a means of exchange. A man who works in, say, an automobile factory, can't take home an air-cushion hover car or two at the end of the month and go around swapping with people for everything from rent to groceries."

The other's eyes, the other's gun hand, didn't waver but he snorted his contempt.

"My cloak and dagger friend," he said, "why is it that each generation thinks *its* institutions unchanging and unchangeable, or, at the very least, that if changes were to be made it must needs be change for the worst? Primitive barter was indeed inefficient and developing a medium of exchange was necessary if international commerce was ever to become the giant it is today. However, this system too is now antiquated. In fact, I contend it is the single strongest factor which prevents the proletariat of both the West and the Soviet Complex from seeing how they are exploited."

"I seem to have missed something there," Paul growled. Half an hour, the other had said, and then the captain was due to return. Why Kavurić didn't simply shout for someone in the crew, Paul didn't know. Perhaps the crew wasn't in on the real nature of the *Lika's* cruise, and Kavurić didn't want the information to spread. It was still very hush. At any rate, Paul had half an hour.

The socioeconomist said, "Your agency should train you a bit more thoroughly in basic economics. The fact is that the use of money, which is, of course, but a symbol for the gold which backs it . . ."

"All money isn't backed by gold," Paul said sourly.

"Ultimately it is," the other told him. "Otherwise, the money becomes increasingly worthless in short order. That was to be seen back in the 1970s when your United States printed more and more paper dollars and sold more and more of the gold she held in Fort Knox. The dollar diminished in value drastically, and inflation zoomed. Meanwhile the Swiss franc, still gold based, and the West German mark, also considerably backed by gold, became the strongest currencies in the West. But to get back to the point. The use of money befuddles the proletariat. A worker is paid, say, two hundred dollars a week. When he is given that, he thinks he has received the full value of his labor, when, in ac-

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tuality, he has received but a fraction of it and has been robbed by his exploiter of the surplus value he has created, be it an individual exploiter as in the West, or the State as in the Soviet Complex."

"Fine," Paul said cynically. "So how would you pay him off?"

"With the labor hour check. The exchange value of any commodity is determined by the amount of the socially necessary labor power necessary to produce it."

"According to Marx," Paul said sourly. "Various holes have been punched in that theory since old whiskers first dreamed it up."

Kavurić chuckled again, but again the gun didn't waver. "You of America fail to take due credit to yourselves," he said. "You who are so keen to claim invention of machine gun, submarine and A-bomb. Marx never contended that he discovered the Labor Theory of Value. In fact, he gives the credit to Benjamin Franklin who developed it in his first essay published in 1721 and entitled *A Modest Enquiry into the Nature and Necessity of a Paper Currency*. You..."

But a new voice interrupted him.

"DROP THE GUN, COMRADE KAVURIĆ!"

Paul Kosloff's eyes shot up to the porthole and for a moment bugged. A glistening black hand, holding a heavy machine-pistol, projected into the cabin. Behind it what would seem a man from Mars, a...

Then he understood. The newcomer was in a frogman's attire.

The elderly socioeconomist stiffened. As though regretfully, his own eyes left Paul Kosloff and went to the porthole. Slowly, his fingers loosened and the gun he had held dropped to the floor.

"Cover him, Kosloff," the newcomer said, and disappeared.

Paul's .38 Noiseless was instantly in his hand. He came to his feet, took a stance in the cabin's corner so that he could face both the seated Balkan and the door.

The door opened, the frogman, his snorkle pushed back on his head, entered. For the moment, Paul covered him, then noticed that the newcomer had his own weapon in a waterproof holster at his belt.

Mikhail Rykov said, in deprecation, "So, at the end of the long road we find ourselves cooperating, eh?"

Paul Kosloff said, "Did you hear what he's been saying?"

"A great deal of it. Enough."

The elderly socioeconomist sat quietly, breathing deeply.

Paul said, "The captain and his mate are due back in a matter of minutes."

Rykov said, "Then we've got to get out of here, very fast. Have you any ideas? I can't return the way I came."

Paul looked at him.

Rykov said, "Two sharks followed me the last five minutes or so. They're bad in these waters."

Paul said, "I have a small boat."

Rykov looked at the elderly radical. "We'll have to finish him."

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Kavurić grunted contempt.

Paul said, "No."

"He'll have the whole ship's company, that part of it that's aboard, after us in moments."

Paul said, "It's better to leave him alive. This is the end of Josip Kavurić as a theoretician. And the end of the United Balkan Socialist Federation as a serious contender for world prestige. Tomorrow, they'll be the laughingstock of all."

Kavurić winced.

Paul stuck a hand into his pants pocket, came forth with the small box and brought a surette from it. Even as the older man opened his mouth to shout, Kosloff slapped a hand over it to silence him and rammed the surette into his arm. The revolutionist struggled, but the American operative held his body until the drug did its work.

Rykov watched impassively.

Paul said, "He'll be out for hours. Let's go."

The Russian following, the flap of his holster open for a quick draw if necessary, Paul Kosloff retraced his steps of less than a half hour ago. This time they met no one along the way.

He flicked his .38 Noiseless back into its rig, located the rope and shinnied down it to the boat. Once there, he called up, "All right, I'm clear."

He could see the darkness of the bulk of the Russian *Chrezvychainaya Komissiva* agent, sliding down the anchor rope. For a moment, Paul Kosloff's hand went back to the butt of his gun and his lips drew back wolfishly. But then he shook his head and the hand dropped away.

The Russian down, Paul took up the oars and began rowing, abandoning the anchor rope.

When they were fully clear of the *Lika,* Paul said, in a whisper, so that his voice would fail to carry over the water, "By morning, it'll be all over. When we notify our governments of the actual source of the so-called new gold, they'll be glad to buy it up, especially at reduced prices. Kavurić's people have been selling it at less than world prices to maintain secrecy."

"So for the once we have cooperated," Rykov said, amusement in his voice. "You needed my appearance to overcome Kavurić. I needed your boat to escape the *Lika.*"

Paul said, "But tomorrow the battle for men's minds goes on, Rykov, and I wouldn't be surprised if the next set of orders you get from your *Komissiya* includes instructions to try and liquidate me."

Rykov shrugged in Slavic fashion. "Nor would I be surprised. However, Kosloff, we might keep in mind that occasion can arise when we have mutual ends. One day—who knows how far in the future—the Cold War will be over. Under what circumstances, once again, who knows? However, matters such as this come up. There should be some—some medium of exchange—of ideas, so that when interests correspond we can communicate."

"I suppose I'll buy that," Paul grunted, surprised at himself even as he said it. ■

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The Reference Library

by Tom Easton

(Note to publishers: Thomas A. Easton's mailing address is Box 316, RFD 2, Belfast, ME 04915. The address given in the November 1979 issue contained an incorrect zip code number.)

Projections, Stephen Robinett, Baronet, 281 pp., $5.95.
The Future at War, Vol. I: Thor's Hammer, Reginald Bretnor, ed., Ace, 391 pp., $2.25.
Car Sinister, Robert Silverberg, Martin Harry Greenberg, Joseph D. Olander, eds., Avon, 253 pp., $2.25.
The Star-Spangled Future, Norman Spinrad, Ace, 401 pp., $2.25.
Rooms of Paradise, Lee Harding, ed., St. Martin's, 182 pp., $8.95.
Thirtieth Anniversary Issue of The Magazine of Fantasy and Science Fiction, Edward L. Ferman, ed., Mercury Press, 322 pp., $2.50.
And the Devil Will Drag You Under, Jack L. Chalker, Ballantine, 274 pp., $1.95.
Home from the Shore, Gordon R. Dickson, Ace, 221 pp., $2.25.
The Spirit of Dorsai, Gordon R. Dickson, Ace, 288 pp., $5.95.
The Ruins of Isis, Marion Zimmer Bradley, Pocket Books, 298 pp., $1.95.
The Karma Affair, Arsen Darnay, Ace, 366 pp., $2.25.
Electric Forest, Tanith Lee, DAW, 159 pp., $1.75.
Macrolife, George Zebrowski, Harper & Row, 285 pp., $12.95.
Modern Science Fiction: Its Meaning and Its Future, Reginald Bretnor, ed., Advent, 327 pp., $10.00.
Genesis Revisited, Glenn G. Strickland, Dial, 183 pp., $8.95.

Many book reviewers are disinclined to cover anthologies. They seem to think novels are more significant or noteworthy. A few admit they avoid the collections because they are in simple truth harder to review, especially if one thinks each story in such a book should be discussed separately.

However, anthologies may need review more than novels. All too many readers reach for a novel because they have seen it reviewed, because it is easier to form an opinion of it with a brief flipping of pages and reading of blurbs, or because they simply prefer more sustained stories. But anthologies—at least potentially—offer better buys than novels. Even a bad anthology may contain one or two gems, while a bad novel is a total waste of time, paper, and money. And a good anthology is hard to beat.

I therefore do not intend to ignore anthologies. I may limit their numbers in this column, simply to have space for novels and nonfiction, but I will cover a few each time around. In the process, I tell myself fondly, I may

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just prove able to affect the kinds of anthologies that are published and the way they are handled. The latter hope is particularly pertinent to Stephen Robinett's **Projections,** which has done more than any book I remember to convince me that blurb writers are idiots. We've all heard of "uncharted lands," unmapped parts of a world, places our imaginations populate with the amazing, the dreadful, the fanciful.

We've all heard of them—all, that is, except the misbegotten half-wit who writes the copy for Baronet's blurbs. He (or she—let's be fair about this) managed to lead off the back cover copy of Robinett's collection with the line, "ENTER THE UNCHARTERED WORLD OF THE IMAGINATION." All in caps, all big letters, and "unchartered," for Pete's sake! The meaning, let us kindly grant, is not what was intended. Who has ever heard of a world of imagination incorporated like a city with its own little charter? Or engaged like a charter boat for a cruise? Or . . . ?

Enough. My gripe doesn't really have a thing to do with the book, and Robinett is a competent, readable (I won't say "great") writer. He well deserves a collection of his favorite short stories, and it is only natural that the collection be an Analog Book, since all of the stories appeared first in these pages, I believe. The title story involves a mind-projector, invented by an advertising man in the name of effectiveness and offered to a politician; fortunately, the pol has more scruples than the ad man. There's "The Linguist," an appealing description of a man who learns languages only to sell his knowledge to others and, this time, wants to finish *Don Quixote* before giving up his Spanish. And there's more, all of it marked by a distinctly light touch, offering smiles and chuckles even when the theme might have been treated more darkly. This makes Robinett's work readable and entertaining, but it does put greatness beyond his reach for now. Somehow, humor and irony rarely seem to make the Honor Roll, though they may sell well enough.

Reginald Bretnor has embarked on a three-volume series of anthologies called **The Future at War,** to contain articles and stories, original and reprint, dealing with the obvious topic. The first volume, **Thor's Hammer,** is out now. It deals with future warfare on Earth and in near space (the later volumes will expand the theater of operations). The contributors include Heinlein ("The Long Watch"), Charles Sheffield ("Fixed-Price War"), Poul Anderson ("Marius"), and Benford, Garrett, Coney, Haldeman, Bryant, and more. The articles, by G. Harry Stine, Pournelle, Dean Ing, Alan E. Nourse, and more, suffer from the defect of most futurology—undoubted shortsightedness—and seem to contribute little beyond the obvious. The stories are all readable, and a few, notably the Heinlein and Garrett's "The Spell of War" (a tale of Lieutenant—later Lord—Darcy), are memorable. But like most theme collections, there is an inescapable uniformity to the book. I finished it eager to get on to the next item in my for-review stack.

Car Sinister is another theme anthology. Devoted to reprinted science fiction dealing with the future of the automobile, it manages to escape monotony surprisingly successfully.

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Perhaps this is because it contains stories as varied as Josef Nesvadba's "Vampire Ltd." and George R.R. Martin's "The Exit to San Breta." Or are they so varied? The two I mentioned just now share a touch of superstition and the supernatural, and so do many of the others in the book, including Gene Wolfe's title story, Zelazny's "Devil Car" and "Auto-da-fé," and Lafferty's "Interurban Queen." Others are more technological, but there remains a sense that SF writers see the car in terms not unlike the way our ancestors saw the night and its bogeymen. The perception is not unjustified, for there is an automotive mystique nestled deeply in the modern Western psyche. There is a sense of freedom associated with the car, but there is also a sense of physical and ecological threat. The ubiquitous machine is a symbol of progress and of isolation, of modernity and of alienation. It is prime meat for the modern mystic, and if it blinds its writers to the most realistic of futures—few of the stories here seem to foreshadow any energy crisis—that only proves its hold on their minds.

A theme anthology that is also a one-man collection is Spinrad's **The Star-Spangled Future.** The theme came after the writing, when Ace's Jim Baen asked him for a collection and he realized he had enough stories about America to make up a book with this title. The theme is therefore loose, too vague—or too broad—to obtrude and bore. The author, on the other hand.... Well, what can one say except that Spinrad is himself as varied as any three other writers? He is guilty of the most arrant nonsense ("The Perils of Pauline") and can yet achieve pungent irony ("Carcinoma Angels"), satire ("The National Pastime"), hilarity ("Holy War on 34th Street"), and pathos ("The Lost Continent"). The last two items are probably the best in the book, good enough to justify the price alone. How you find the rest of the book will depend on your tastes, but you shouldn't be put off by Spinrad's reputation for stylistic inconsistency (a complaint once voiced by Algys Budrys). Spinrad says that he seeks to fit style to theme and topic, which is not only appropriate but necessary, and this makes his work peculiarly suited to a science fiction anthology about America. As he says in his introduction, "Both 'science fiction' and 'America' are multiple states of mind; indeed the only way to define either of them is by their very multiplicity."

Neither theme nor one-author collection is the international **Rooms of Paradise,** edited by Australian Lee Harding and first published down under. The contents are varied in origin—America, England, Australia, and Japan are each represented—and in nature—technical, psychic, fantastic, social. All the stories are good to excellent; the best may be Sakyo Komatsu's "The Savage Mouth," an incisively disgusting fable.

But for all the praise I've handed out to the books above, there remains one anthology that is the best I have read in many years. Except that it isn't really an anthology. It's the thirtieth anniversary issue (October 1979) of *The Magazine of Fantasy and Science Fiction.* And though a book review column is hardly the place one might expect to see comments on a magazine, this issue is such a good example

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of the reprint anthology that it would be a crime not to mention it. Ed Ferman, F&SF's editor, has filled the pages of this issue with practically nothing but gems, classics, award-winners. There are Bester's "Fondly Fahrenheit," Sturgeon's "And Now the News," Knight's "Not with a Bang," Keyes' "Flowers for Algernon," Miller's "A Canticle for Leibowitz," Heinlein's "All You Zombies. . .," Henderson's "Ararat," and more, more, more. Ferman is an idiot if he doesn't try to get this selection of stories issued as a bonafide book (and so I weakly justify covering it now). All other anthologists are idiots for failing to achieve similar heights of excellence, especially when they have more than one magazine to glean from. And Stan Schmidt's an idiot as well if he doesn't think about doing a similar anniversary issue of Analog. The material is there, and the mag is *fifty* years old this year. If you like the idea, let him know.

And that's it for the anthologies. This month's novels begin with an item by Jack Chalker, a fellow who's been turning into a pretty busy writer in the last few years, spreading out from his fan activities and Mirage Press. **And the Devil Will Drag You Under** is an end-of-the-world story with a difference. This world—this universe, in fact—was created as an environment for laboratory experiments by an alien race. So were a large (infinite?) number of parallel universes. But not all the universes are actively being studied at the moment. Some, like Earth's, are places of exile for megalomanic aliens, and Earth's particular fruitcake is the devil, Old Nick, the alcoholic Asmodeus Mogart. And Earth is threatened with destruction by a runaway asteroid.

Asmodeus, of course, wants to save his cushy cell. To do so, he must obtain five "jewels of power" from exiles on other Earths, add them to his own to create a six-fold "Eye of Baal," and wish the asteroid out of the way. He recruits two humans, male and female, and sends them through a handful of unlikely adventures to beg, borrow, or steal the jewels. They succeed, and Asmodeus succeeds, but all is not what it seems. The Eye of Baal gives its possessor immense power, and this has been Asmodeus' aim all along. The details of his machinations and the *dei ex machina* that provide his comeuppance I will leave you to discover for yourself. I assure you, the discovery will be enjoyable.

Gordon Dickson has joined Ace's stable of "illustratable" authors. **Home from the Shore** is basically a novelette, familiar because it once appeared in one of the SF magazines. It concerns the conflict between two branches of humanity, those who have used technology to take to the sea, companying with whales and dolphins, and those who have remained on land and gone into space. The sea-born are developing a number of unique talents which the land-born would like to exploit in space, but there are prejudice and lack of trust on both sides, and the conflict ends with the attempted extermination of the sea-born. The story is moving enough, though told in a flat, simple style, and as we know we can expect from Dickson it is a pleasure to read. The critical appraisal at the end, by Sandra Miesel, is an interesting extra.

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The story is only a novelette, however. It was turned into a $2.25 book by combining it with a thick portfolio of drawings illustrating the story, and to my mind this makes it a bad buy. The artist, James R. Odbert, is competent enough (no more), and the package integrates well, but the artwork is largely unnecessary. Dickson's prose should be enough for literate readers, and the illiterates should stick to comic books. Publishers should have the sense (or manners?) to refrain from bastardizing decent writing, even when the bastards do sell more copies.

The combination of art and prose is a little more restrained with **The Spirit of Dorsai**, a pair of novelettes illustrated by a more appropriate number of drawings, this time by Fernando Fernandez. The novelettes are "Amanda Morgan," which describes the defense of the Dorsai homeworld against Dow deCastries' punitive invasion, and "Brothers," the tale of how Kensie Graeme's murder was avenged. Both are peripheral to the main thread of the Dorsai saga, both throw interesting light on the Dorsai people, and both are worth reading in their own rights. The framework of historical reminiscence that knits the two into a pseudonovel does little more than suggest the state of affairs toward which Dickson's Childe cycle is moving.

Marion Zimmer Bradley has departed from the spirit of her Darkover stories with **The Ruins of Isis**, a love story that is an angry/tender treatment of the roles of men and women. It is feminist, but at the same time unusually rational and realistic. Isis (aka Cinderella) is a female-supremacist world; men are property. The ruins are remnants of a long-gone civilization. The protagonist is an anthropologist—representative of a profession banned from Isis—disguised as an archeologist invited to study the ruins. Her husband, a genuine archeologist, is disguised as her assistant. The complications are obvious, and they are further convoluted by politics and the reality of the voices that inhabit the ruins and speak only to women. The tale's denouement follows on a natural disaster that leads to the voices addressing men for the first time and stimulating the first steps toward a civilization of true, sharing equality. How far those steps will or can lead is a question Bradley leaves open, recognizing the difficulty of compromise, of rearranging well-learned response patterns. Nevertheless, her wish for the best for everyone, her sense of concern for fairness, her love for people, all shine through the veil of story and words. It is difficult to read the book without feeling that Bradley is saying "I love you" to all her fellow members of our species.

Arsen Darnay's **The Karma Affair** is another matter, for it holds a less than optimistic view of human frailty, villainy, and idiocy, saying that personal happiness or peace is something to be obtained only with great pain and struggle and not to be obtained at all within the limits of just one life—or one handful of lives. The premise is suggested by the title: the soul and reincarnation are real, and one strives to improve from life to life. The plot gimmick is a device for trapping and conditioning a naked soul so that its subsequent life is not its own. The device is the invention of a man who is

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caught up in an eternal triangle with a woman and a lives-long opponent, and the story follows device and triangle as the one is applied to provide eternal custodians for nuclear wastes and the other twists through iterated lives. The inventor's vengeful use of his device makes his opponent aware of his fate and gives him some control over it, and hence leads to the generations-later defeat of the inventor's efforts.

This description is a pale version of a complex, unlikely mixture of technology and mysticism. If it seems familiar, pieces of the novel have appeared in the magazines. So, I believe, has at least one peripheral story that might have been included in the book if it had been a bit more closely integrated with the karmic pattern.

DAW is an awkward publisher to deal with. A reviewer has either to buy the books or to write New American Library, which then sends a monthly brochure and checklist, which the reviewer returns, suitably marked. Then, the reviewer may get one or two DAW titles. A recent one is Tanith Lee's **Electric Forest**, the tale of a poor ugly duckling of a woman in a world of beautiful people, who is given a gorgeous android body by a mysterious rich man, whose aims turn out to be less than noble. Except that they are really as noble as can be, the ugly duckling is really a swan, and the story was all a dream—sort of. I leave you to learn for yourself when a dream is not a dream (when an author wishes to avoid outright cliché, while still giving her story an extra level of complexity?). You may not like Lee enough to read the book, however. She has written a fair amount of fairly good fantasy and science fiction recently, but her strength is very much more in her stories than in her prose. She is given to the worst sort of unnecessary coined words ("glazium," "flexium," etc., here), and she is ornately fond of adjectives. Hardly mortal sins, but not something that all of us tolerate gladly.

George Zebrowski's prose, on the other hand, is simple and spare to a fault. He avoids superfluous description to the point of telegraphy, to the point where his characters at times seem not even to be listening to each other. But this is not the major defect in **Macrolife**. The novel describes the kind of grandiose future that used to be a staple of science fiction. He has taken the idea of large artificial worlds, built in and around asteroids, powered for travel, and capable *en masse* of supporting inconceivable populations, as proposed in the early 1960s of Dandridge Cole and called by him "Macro Life." He has described their origins in response to an early 21st century catastrophe (the "synthetic element" bulerite—or bulerium, more than once; actually a more apt name—proves unstable after twelve years of penetration into civilization, disintegrates, and makes Earth uninhabitable). This first portion of the book is the only part that resembles a modern novel; the vicissitudes of the Bulero family, responsible for bulerite and the disaster, make an absorbing, dramatic story. The rest of the book, which traces the development of planetless humanity in Macrolife vessels, its encounter with a similar civilization, and its galactic integration into an ultimate superorganism, is a travelog, thinly stretched on threads of

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plot adorned with long lectures on the design and operation of artificial worlds, their sociology and their relations with planetary cultures, and the philosophical, significance of the concept. The end involves another lecture on cosmology as the vessels of Macrolife ride the collapsing universe through the black hole-monobloc to a new universe. For all the grandeur of its concepts, and for all the quality of the beginning, the book is a tedious read. The concepts are new, but in many ways the book seems fifty years past its time, not least in its one-sided portrait of the future as a triumph of technology alone. There are no clues to the nature of future art and literature, and such clues would have helped give flesh to the book's characters.

I'm running out of space now, but I do want to devote a few paragraphs to two nonfiction works. One is **Modern Science Fiction: Its Meaning and Its Future**, edited by Reginald Bretnor. This is an "Expanded Second Edition"; the first was published in 1953, and it has been expanded by the addition of a short foreword, an index, and a list of updates and error notes. It's not much of an expansion to justify a second edition, but the book has weathered the years remarkably well. Except for references to such things as $2.50 hardbound books (!) and a few outdated predictions (the first slick SF mag didn't come along till *Omni,* unless you count *Vertex* or the ill-fated Analog experiment in the mid-60's), the book might have been assembled last year. An example will suffice: Don Fabun's chapter on audiovisual SF makes the point that putting magazine and book SF on film or TV is rather like converting the columns of the old *Saturday Review* into an issue of *Life;* it could be done, but much of what made (and makes) *Saturday Review* what it was would be lost in the translation. The analogy remains valid.

The book also contains chapters by younger versions of L. Sprague de Camp, Isaac Asimov, and Arthur C. Clarke, as well as by the late John Campbell, Anthony Boucher, and Fletcher Pratt. Voices from the grave, they seem, but speak they do, and still to a point.

Glenn Strickland has striven to open another grave by applying his experience as an operations research analyst to the problem of human evolution. **Genesis Revisited** will agonize all anthropologists who read it, for it is a morass of oversimplifications and misunderstandings and "explanations" of human features of the sort familiar to all parlor etymologists (etymology is the study of Aunt Etta, the gangster's moll, right?). But there is buried in this slim book an intriguing and testable hypothesis; fifteen million years ago, when an ape was taking the first steps toward humanity, the Mediterranean was a hot, dry valley, and if these steps were taken there, the shortage of prehuman fossils becomes explainable. The idea can be checked by a thorough search of the valley's mountaintops (Cyprus, Sicily, Sardinia, the Balearics, etc.) for these fossils. After all, when the valley flooded, its residents would have been left high and dry on these islands, to escape only when the ice ages provided land bridges. They would have escaped in waves, first as the Australopithecines, then *Homo habilis, Homo erectus,*

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and then, says Strickland, as Neanderthal man, Cro-Magnon, and ourselves (he seems ignorant of the evidence for continuous descent from *erectus* on, and that Cro-Magnon *is* us). For lack of food on the islands, our ancestors would have sharpened their wits on each other and so provided the environmental pressures for our rapid mental evolution and left us our propensity for internecine strife.

Because Strickland is often plausible, I would like to caution his readers that if he proves right in his basic point (the Mediterranean), that does not automatically make him right about everything else he discusses. A similar confusion has made martyrs of too many crackpots such as Velikovsky, and if I can prevent another example here, I will count myself and the world fortunate. ■

probability zero

PAUL J. NAHIN

Monster's Meal

The whole unfortunate business occurred when Hubert Undersquat, science fiction editor extraordinaire, rejected Willard Pumpersnout's latest submission. In itself, a not surprising event, as Undersquat had bounced all of Pumpersnout's previous creations.

But this time he added a rather sour note to the standard rejection. "The scientific basis for this story is so obviously incorrect that even a fool could see it!"

This so enraged Pumpersnout (who fancied himself a rather brilliant inventor in real life), that he shortly thereafter appeared in Undersquat's office, bearing with him his latest gadget. "Call me a fool, will you? Well, take a look at *this*, Undersquat, and see if a *fool* could have conceived it!"

And with that, Pumpersnout energized the Hyperspacial Mega-Time Warper. Within nanoseconds, both men materialized in a parallel Universe, populated mostly by telepathic monsters of voracious appetite and a pathetic weakness for a good after-dinner cigar.

Indeed, one of these slimy horrors was but mere centimeters from them as they popped into view. Reading their minds in a flash, the monster quickly engulfed Undersquat and ate him, all the while emitting a vast assortment of disgusting squeals of pleasure. Fortunately, none of these horrid noises can, in good taste, be reproduced here.

Turning to leave, now that its nauseating meal was done, it lit a cigar and left Pumpersnout untouched. "Wait, wait," cried Pumpersnout, "why not me, too? Why have you spared *me*?" Under the circumstances, a strange question to ask, you ask? Well, maybe Undersquat *had* been right about Pumpersnout's IQ.

In any case, the creature turned slowly back, blew a smoke ring in Pumpersnout's face, and replied, "You are a writer. And your companion was an editor. Correct?"

"Yes, that's true. But what has *that* to do with it?"

"Are not editors readers of manuscripts?"

"Yes, yes!" shouted Pumpersnout, "but so what?"

"Ah, you *must* be a fool not to see it. It is so simple. Readers digest. Writers cramp."

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Brass Tacks

G. Harry Stine's November guest editorial, "Beyond Relativity," drew a large number of letters, some applauding the basic points and some challenging points of fact or opinion. The following is one of the clearest and most thorough of the latter.

Dear Dr. Schmidt,

I want to point out several pieces of misinformation in G. Harry Stine's guest editorial, "Beyond Relativity," which appeared in the November, 1979 issue of Analog.

I see from my copy of A.A. Michelson and E.W. Morley's paper (*Philosophical Magazine*, series 5, December, 1887) that they did not find an 8 kilometer per second (kps) velocity difference as Stine claimed. They expected a difference of 60 kps between the speed of light coming from the direction of the Earth's motion around the sun and the speed of light moving in the opposite direction. Their data contain no systematic variations in lightspeed associated with any particular directions in space. Two graphs of data for noon and midnight observations are shown, comparing results gotten in the same directions in space. The slight differences from zero variation are not consistent. Fluctuations in any interferometer measurement due to temperature changes (which make the apparatus expand and contract noticeably) and distortions of the rotating stone on which the interferometer rested caused random and nonreproducible variations from a null result. The largest fluctuations were about 1/13 the maximum theoretical variation. Michelson and Morley estimated their possible experimental errors due to irrelevant effects and reported that the velocity difference between the Earth and a hypothetical luminiferous ether "is probably less than 1/6 and certainly less than 1/4" of the Earth's orbital velocity. By this they meant that a velocity difference of 5 kps might have escaped notice, but 7.5 kps could not have.

This certainly does not constitute detection of an 8 kps result, and Stine's claim is a complete abuse of statistics. If you don't like those uncertainties, the experiment has been done more recently. T.S. Jaseja, A. Javan, J. Murray and C.H. Townes reported results from a more sensitive method of interferometry (*Physical Review*, vol. 133, no. 5A, 2 March 1964). Their experiment could have

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measured differences in lightspeed smaller than 1/30 of the speed of the Earth's motion (the effect on the interferometer depends on velocity squared, so this is 1/1000 of the expected interferometer measurement), but they found none. Their uncertainties were mainly due to magnetic constriction of the rotating apparatus by the Earth's magnetic field. This effect mimics the lightspeed velocity difference because it varies with rotation of the interferometer in space in the same way, but over long observation it averages out to a zero net effect. Miller and Kantor probably failed to account for this large spurious effect.

There are many other ways of confirming the independence of the speed of light and Jaseja et al cite a few in their paper. It is just not true that rechecking of this famous result isn't being funded or published (e.g. *Nature*, vol. 271, p. 13, 5 Jan. 1978, "Speed of Light and Relativity" by P.E. Hodgson). Notice in reading "Beyond Relativity" that Stine doesn't explain just how lightspeed depends on the motion of the observer because he doesn't know. He has merely tried to see a pattern in random experimental errors, and has overlooked a lot of recent, more carefully done work.

Anomalies in the orbit of Mercury alone could be explained by deviations of the sun from a perfectly spherical shape, but probably not by drag from the extremely tenuous solar atmosphere. But data now exist (p. 198, S. Weinberg, *Gravitation and Cosmology*, 1972, John Wiley & Sons) for Venus, Earth and the asteroid Icarus which agree with ER (Einsteinian relativity). If "r" is the average distance of an orbiting body from the sun, a nonspherical sun or solar wind drag would create anomalies proportional to 1/r squared. The real anomalies are proportional to 1/r, as predicted by ER.

For the passage of light near the edge of the sun, the corpuscular theory of light predicts a deflection of 0.87 seconds of arc. This is 1/2 of the result in ER, 1.75 seconds, not the same result as Stine reports from Soldner in 1805. Photographic measurements vary a lot because the solar atmosphere bends light and some other kinds of electromagnetic radiation, but the results from 1919 to 1952 all lie between 1.3 and 2.7 seconds of arc, in fair agreement. Another way to do this is to use radio waves, which should be subject to the same deflection. A radio telescope can be used to watch extra-galactic radio sources, some of which pass behind the sun every year. A radio frequency can be used which is not effected strongly by the solar atmosphere. This has been done regularly since 1969 and the results have varied from 1.57 to 1.87 seconds of arc. This isn't a case of selecting particular stars as Stine accused the photographic investigators of doing. If ER is false, this agreement of theory and experiment is totally accidental and most unlikely.

The inference of J.H. Taylor, L.A. Fowler and P.M. McCulloch (*Nature*, vol. 277, p. 437, 8 Feb. 1979) that gravitational radiation is causing the pulsar PSR 1913 + 16 to slow down its pulses is still controversial, but H. Ritter has reported that an eclipsing binary star, Z Chamaeleontis, is also slowing down at the expected rate if the slowing is due to loss of momen-

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tum in the form of gravitational radiation (*Nature,* vol. 281, p. 199, 20 Sept. 1979). This star is not a pulsar, so the approximation formula used in the computations should be valid, which is the major cause of disagreement.

These facts are not inaccessible as G. Harry Stine claims. Looking up "Relativity" in the subject index of many of the respected journals of physics available at a good university library will lead the interested reader to many recent articles describing tests of the accuracy of ER. There are a lot of respected people who find other theories more attractive, such as the Brans-Dicke theory, or the bimetric theory, but none of them have been able to offer irrefutable evidence. *General Relativity and Gravitation* (Plenum Press) is a monthly journal in which other theories of relativity are studied on an equal footing with ER. *Gravitation,* by C. W. Misner, K.S. Thorne and J.A. Wheeler (W.H. Freeman & Co., 1973) lists fifteen of them and compares their observable consequences. This doesn't sound like inflexible adherence to a monolithic doctrine.

I am most surprised that Stine has not reported the true failures of ER that all relativists admit. ER can't be completely true because it is a classical theory and not a quantum theory. ER fails to tell us anything about physics taking place over distances shorter than 1.6 x (10 exp -33) centimeters where quantum gravity must reign. No good, complete theory of quantum gravity has been found and relativists like to hunt for effects of the breakdown of classical ER such as S. Hawking's evaporating and radiating miniature black holes. In this sense Stine is correct that a new general theory, unifying all physical laws, is needed and relativists agree. But to date no experimentally measurable consequences of quantum gravity have been found, and ER allows us to understand the expanding universe, the 3 degree microwave radiation filling the universe which remains from the Big Bang and many otherwise unexplained physical facts (S. Weinberg, *The First Three Minutes,* Bantam Books, 1979).

So I can't agree with Stine's assessment of modern physics as a quasi-religious decadent farce. His quixotic attack on sub-nuclear particle physics merely consists of a few out-of-context facts. And of course there are politics and in-fighting in modern physics, as in every other field of human endeavor, but no matter who puts forth a theory, if it fails to work in the laboratory where it counts, this is soon known and admitted and we all move on to find something that does work. Take Newton's 2nd Law: a body accelerates at a rate proportional to the force applied to it. When people began to accelerate atoms to high speeds, they found that the 2nd Law failed, as ER predicted. Application of tremendous electric force could never push those atoms beyond or even quite up to lightspeed. The acceleration just died out, despite the force. This is the fundamental laboratory-tested fact that renders interstellar flight so difficult; a phenomenon, not a theory subject to interpretation, but ER describes it accurately. A star drive will have the same problem unless it can dodge into hyperspace where normal physics doesn't work, or some such trick. I'd

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love to see it too, but I'm not convinced to disregard a theory as successful as ER has been just because of the misrepresentations in "Beyond Relativity."

Stine's intense desire for physics to permit a star drive seriously biases him. The skeptical reader should pursue this further through the references, instead of just making a subjective judgment of whether Stine or I grind the better axe.

I'm a graduate student (B.S. Physics, MIT, 1977), working toward my Ph.D. in physics, and a regular Analog reader. I don't appreciate finding such poorly-researched material in Analog. Until I read this editorial, I had always found Stine's columns entertaining, informative and stimulating. I hope that you, Dr. Schmidt, have merely been indulging in a little mischievous provocation of controversy by printing it. I have enclosed copies of several of my references and would like to see you publicize your opinions if you support Stine's position.

David Batchelor
Department of Physics
and Astronomy
University of North Carolina
Chapel Hill, North Carolina

Let us remember some points of definition. An editorial is a statement of opinion, supported where appropriate by facts, for the correctness of which the writer is responsible. "Beyond Relativity" was deliberately run as an editorial, not a fact article. I agree with those readers who said that its tone (described by a couple as "strident") was not appropriate to a fact article and that some of the statements were open to question. Some of them I disagreed with myself, but I do not consider it appropriate to make someone else's statement of opinion conform to mine. In general, I will not require changes in such pieces except in cases involving a danger of lawsuit.

Mr. Stine's basic *point, that many scientists (and please note that he did* not *say* all*) tend to accept both statements and interpretations of relativity (and other theories) with too little thought about where they came from and what limitations they may have, I do agree with. As a physicist myself, I'm well aware that relativity has solidly demonstrated a large range of validity—and also that some physicists are not very willing to think about possible limitations on that range. (May I suggest my own editorial, "Extrapolation," in our February 1979 issue?) I suspect that Einstein* would *find this sort of attitude disconcerting, and it is good for any practicing scientist to check himself for it from time to time. Those whom the shoe does not fit need not wear it.*

However, it is also true, as Mr. Batchelor points out, that more recent work has been done and published than the editorial might lead you to believe. The point about the significance of the 8 kps "discrepancy" is well taken: like all such numbers, it doesn't mean much until you know its context. E.g., was it within the inherent uncertainties of the experiment, and if it was obtained several times, were there any systematic *errors common to all the repetitions?*

This context you could learn and judge for yourself if you heeded perhaps the most important statement in the editorial: the advice that you should do your own homework and

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check up on the sources—including, as Mr. Batchelor and others point out, seeking out sources beyond *those cited by Mr. Stine.*

An unusual number of you did that —and in connection with that, I have two closing observations.

(1) Would as many of you bothered if the tone of the editorial had been less "strident"?

(2) Several of you checked different sources and came up with conflicting information.

Moral: If something is really important, don't take what anybody *says—Mr. Stine, me, your friendly neighborhood physics professor, or anyone else—as the Last Word without doing some critical evaluation of your own.*

Dear Mr. Pournelle,

Regarding your column "The Alternate View" in August's Analog wherein you advocate the relative safety and efficiency of nuclear reactors vis à vis the other energy sources currently available. One subject which I have not seen addressed and which I would like to know the effect of is this. What would happen if a bomb were to be dropped on a nuclear reactor, or a number of nuclear reactors, during World War III? How about the possibility of a terrorist dropping an explosive equivalent to a ton or two of TNT from an airplane?

Stuart Suss

P.O. Box 1375
Grand Central Station
New York, New York 10017

Mr. Pournelle replies:

U.S.-designed reactors are enclosed in a massive steel-and-concrete structure known as a containment. The containment is the most characteristic building on the reactor site; in older models it was spherical, although later ones are generally cylinders.

The specifications are such that to penetrate the containment would require a lot of explosive. It is supposed to withstand a direct hit from a fully-fueled airplane. Thus it is unlikely that any bomb available to a terrorist group would rupture the structure. As to nuclear weapons, if WW III breaks out, the additional damage caused from hits on nuclear power plants would literally be lost in the noise.

Incidentally, Soviet-designed reactors, including the one they are about to install in Cuba, have no containment, and your question might appropriately be asked of the Cuban delegation to the UN.

Dear Stan:

Your September editorial "Irreproducible Phenomena" inadvertently touches on one of the more basic areas of philosophical study: epistemology (the study of knowledge). Epistemology, as you probably know (but some readers may not), deals with the questions "What can we know?" and "How can we know what we know?" Which brings me to the inherent problem in postulating a class of phenomena which are irreproducible: it is impossible to know anything about such a class of phenomena (if indeed it is possible to give any sense at all to the concept).

When we talk of knowledge about a given object or phenomenon, we are referring to information which can be, and in fact has been, verified by appealing to an outside authority, or by

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repeated observation of the object or phenomenon. In the absence of any such possibility of verification, our experiences must be relegated to the status of subjective impression. The man experimenting with the television during the bumpy train ride would be quite correct in interpreting his results as unreliable and possibly hallucinatory; he has no basis for comparison. It is only our repeated experience with consistently functional televisions that allows us to have *knowledge* of televisions. By the same token, a person who has suffered a hallucinatory episode can classify his experience as subjective and unrelated to the real world, precisely because it conflicts with his much vaster range of experience in the real world. An irreproducible phenomenon would also fail to match normal experience and have to be interpreted accordingly.

All of which is not to say that parapsychological manifestations do not or cannot exist; but if they do, it is as reproducible phenomena. Unmeasurable as yet, perhaps, and severely hampered by unidentified influences, but reproducible nonetheless.

At the present time, however, the legitimate study of such matters suffers from shady instances (performance failing in direct proportion to the stringency of observation, post-experimental determination of data interpretation procedures yielding strangely serendipitous results, and the like). If your readers are interested in just how much has been proven in the various areas of parapsychology, as well as other alleged paranormal phenomena, I recommend reading *The Skeptical Inquirer,* published quarterly by the Committee for the Scientific Investigation of Claims of the Paranormal.

Michael Parmenter

P.S. I am not a member of CSICP.

112 Rainbow Creek Road
Sedalia, CO 80135

It wasn't inadvertent at all, but your reference to epistemology leads me to musings on tautology*—you argue that such a class of phenomena cannot exist because it can't be studied by the usual methods, which are themselves based on certain* assumptions *about the kinds of phenomena that can exist! What I proposed is that you try to consider the possibility that such phenomena exist in* spite *of your prior assumptions, and then try to imagine what* new *ways of study could be developed to lead to useful information about them. Such information would not be in the form of ironclad, always-reliable rules, by the nature of the beast, but maybe something statistical—or maybe something else that nobody has ever verbalized yet. The man with the unreliable television set would be correct in interpreting his results with caution, especially in their earlier stages, but he would* not *be correct in deciding that they were* definitely *hallucinatory and not real. He would not be correct because his conclusion is at odds with what was actually happening outside him; to be conscientious, he would have to give very serious consideration to the possibility that he wasn't aware of everything that was going on. Ideally, he needs methods that will let him say something meaningful about what happens on those occasions when anything happens at all—even if the picture only comes on once before the wire lets go for good.*

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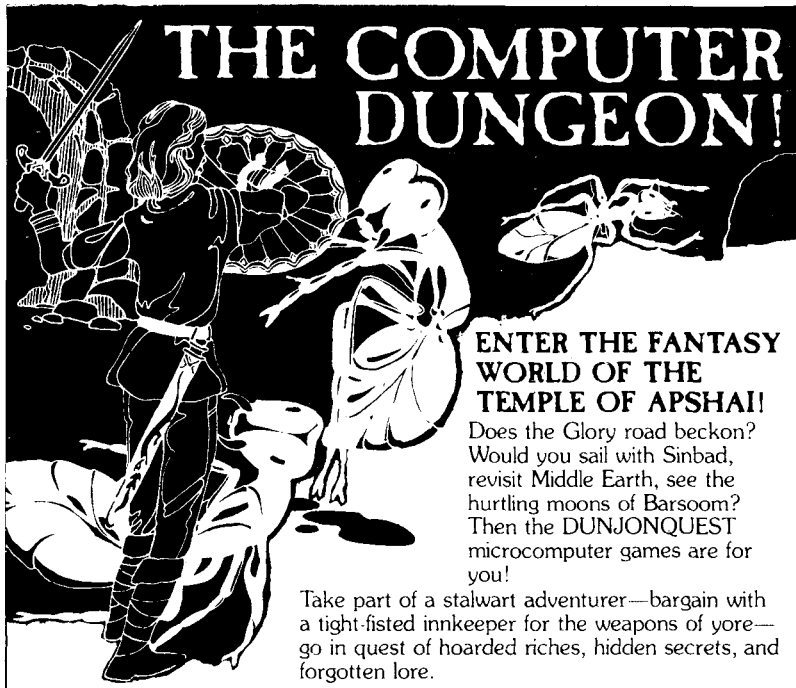

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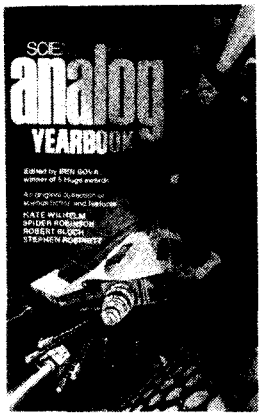

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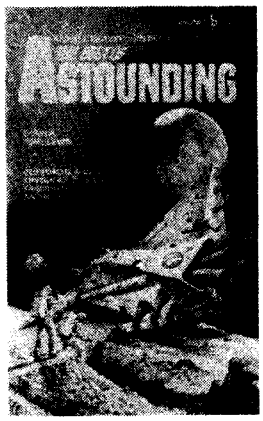

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